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JULY TO DECEMBER

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Authors' Index

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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(Corrected from last issue.)

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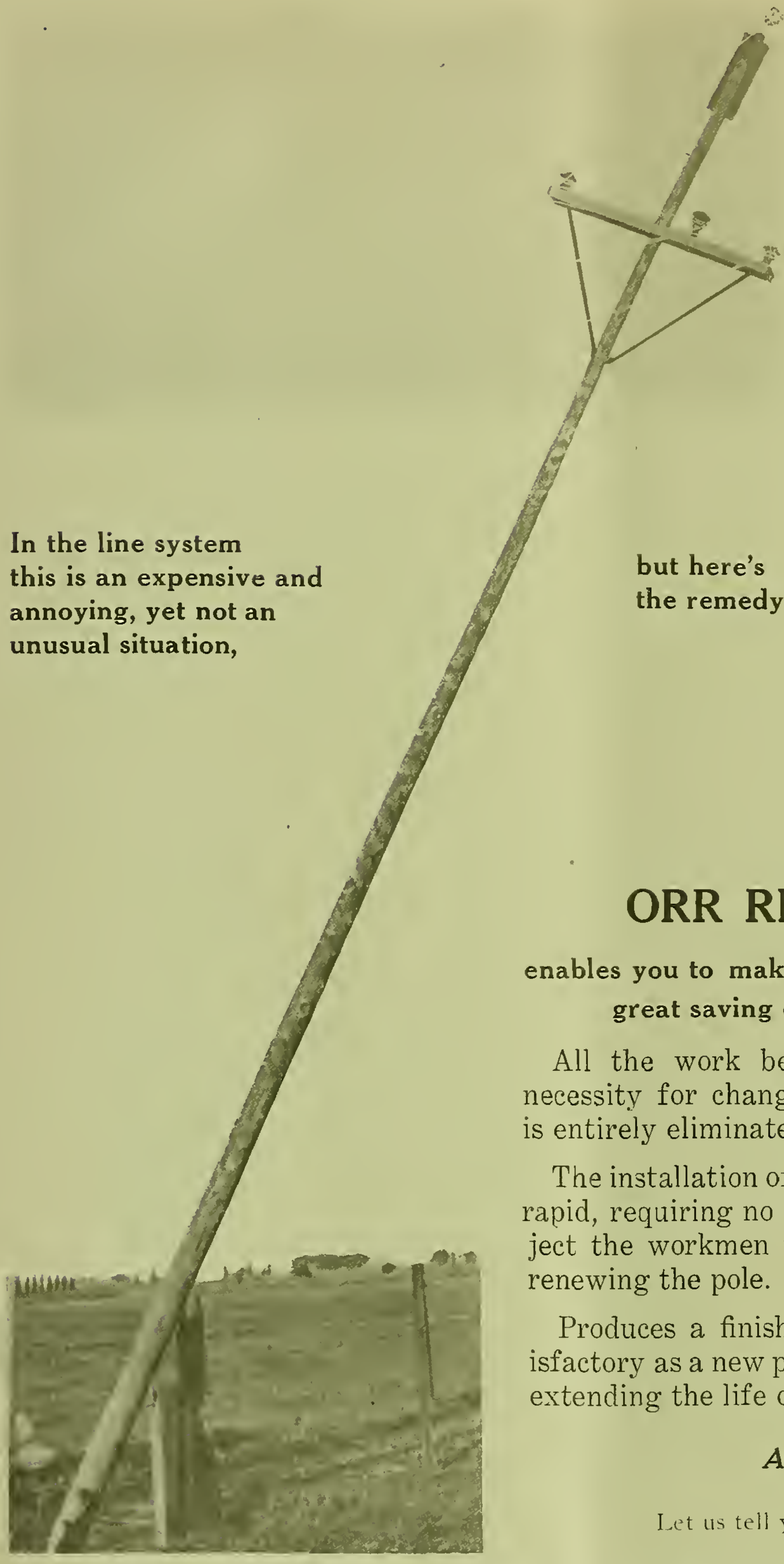

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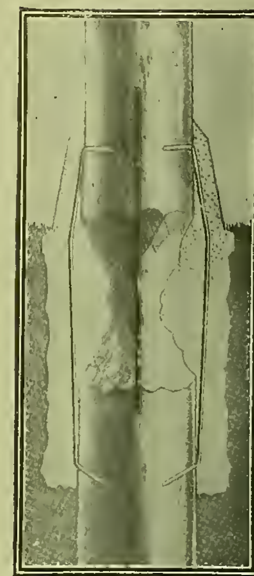

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI | SAN FRANCISCO, JULY 5, 1913 | NUMBER 26

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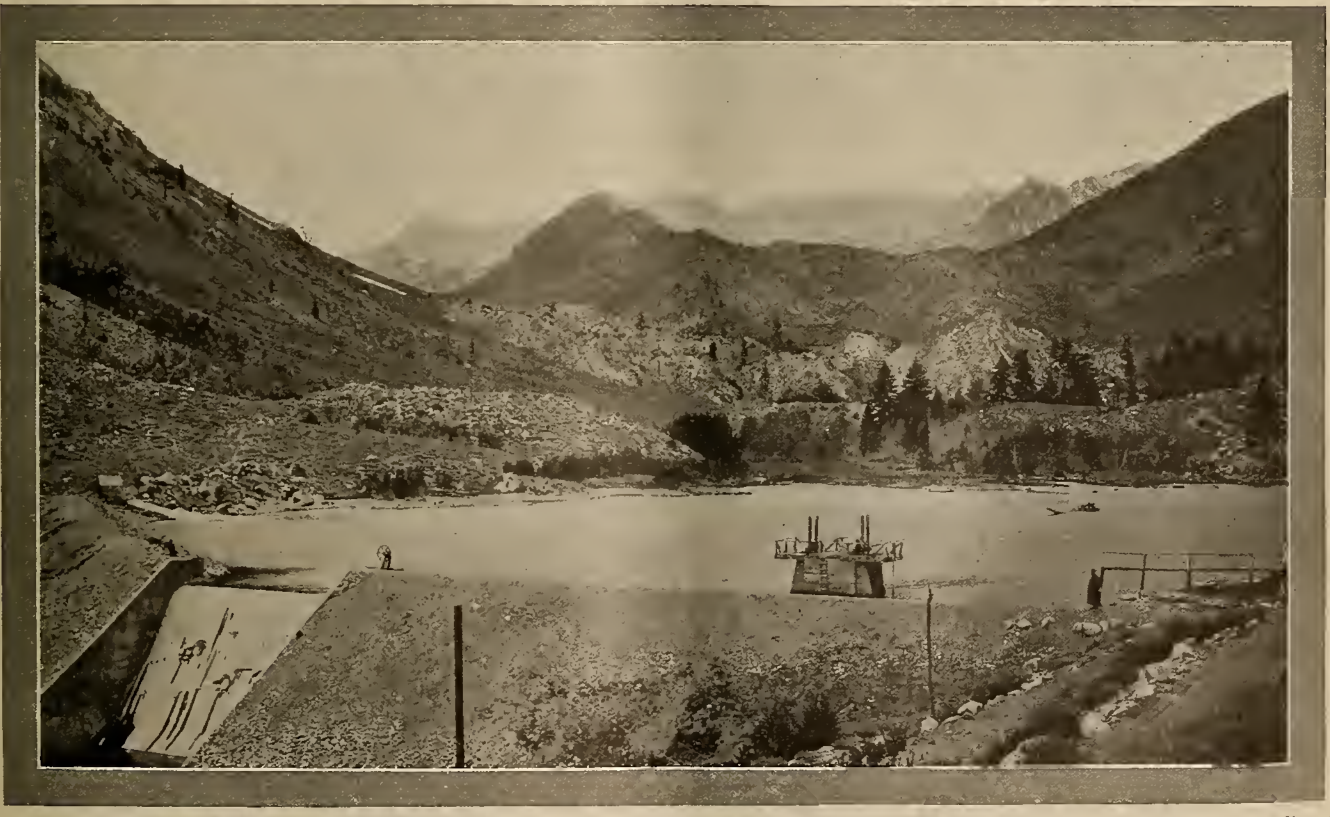
SYSTEM OF SOUTHERN SIERRAS POWER COMPANY

PART I — POWER PLANTS

BY RUDOLPH W. VAN NORDEN.[1]

There is a vast territory extending from the abrupt rise of the Sierra Nevada as its western boundary, easterly and including the southern part of the State of Nevada and southerly to the San Bernardino Mountains, possessing untold potential wealth. This area of twenty-five thousand square miles, part plain, part mountain range, is looked upon by those who have perchance but crossed it in a Pullman car, or who have learned of its existence from their geographies, as a desert. On the maps one will find the names Mojave Desert, Indian Wells Valley, Panamint Mountains, Funeral Range, Amargosa Desert, Death Valley. To the uninitiated, the city dweller, there can seem but little promise in this expanse of arid country unless it be for minerals in countless variety known to exist hidden in its geological cosmos. The development of a system to transmit and distribute over this area, electrical energy for every sort of commercial use would seem to be an exploitation of fanciful fields. But to the one who has lived in and studied this desert its lure becomes a fascination that cannot be shaken and it is he who knows that locked within its reaches is boundless wealth, not only mineral wealth, but productive lands, deep rich soil and millions of acres of it almost for the taking, providing that there can be supplied that which nature failed to supply—water. All this has, of course, been known



Intake and Forebay Reservoir of No. 2 Powerplant. No. 1 Powerhouse Will Be Placed Near Pile of Rocks in Left of Picture. Lake Sabrina Lies to Left of the Butte in the Center Background.

[1]Fellow, A. I. E. E.; Member, A. S. C. E.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0 10 20 30 40 50

and understood since man has known the desert, and the insurmountable problem was met and conquered only with the advent of power, within the means of the individual, for obtaining water by pumping.

The seasons in this country produce a winter which lasts, in the higher altitudes, from November to May, and snow in quantity increases with the altitude, while in the more level stretches rains more or less torrential occur. The mountains, oftentimes rising to elevations of twelve thousand feet, except for the greasewood and sagebrush covering which is common to these desert areas, are bare. The canyons, ravines and gulches which make up the countless serrations in the mountain sides are steep and ragged and the runoff from the melting snows becomes angry torrents at the beginning of the summer season. Likewise the downpours of sudden rains cause the ordinarily dry arroyas, which head into the mountain canyons, to become for short periods dangerous watercourses whose floods carry boulders and trees and brush before it and may be the means of destroying railroads or other works of man which are in its path. It is thus from this lack of conservation that the sudden floods, soon dissipated in the more level stretches by sinking in many cases to form underground strata of moisture, leave the surface of the country a dry waste throughout the six months or more of summer under almost cloudless skies.

Hauling Cement in Winter.

To pump water for irrigation or to obtain power for operating mines or other industries becomes a serious problem, there being practically no local fuel, and the importation of fuel, due to few railroads, high freights and high hauling charges, makes the cost of power almost prohibitive. The generation of electricity from the power of falling water in most instances becomes impracticable because of the impossibility of conserving the flow to allow of an even distribution throughout the year.

In the northern extremity of the area under discussion, there is a fairly flat and wonderfully fertile valley, over 100 miles long and six or seven miles wide. This area, known as the Owens valley, lies in a north and south strip, itself at an elevation of 4,000 ft., between the line of summit peaks of the Sierra Nevada and the White Mountain range, almost as high. The Sierra Nevadas, many of whose peaks are above the 14,000 ft. elevation, deliver into the Owens valley through deep and steep canyons, one after another, the runoff from its eastern slope. Some of these streams possess a very considerable watershed area and the runoff is large from the time of the melting of the snows to the Fall months and in fact until the oncoming winter when the resulting cold in these higher areas causes a diminution in the flow.

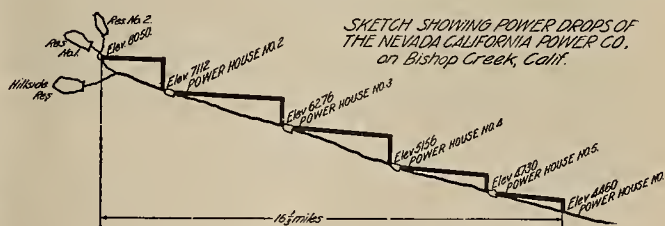
The opportunity for the development of hydroelectric power in many of these streams would be ideal if nature had provided means of storage. But in most cases storage among these beetling cliffs and peaks would become so costly as to be prohibitive.

The Owens river having its source in the mountains at the northern extremity of the valley is fed from the streams of the Sierras and gathers in volume, much of its flow passing underground, however, until it is poured into the Owens Lake at the southern end of the valley. This lake has no outlet and is therefore strongly alkaline and in itself supplies the raw material for chemical recovery works of various kinds.

Of the streams feeding the Owens river, one of the largest is Bishop creek. This creek has its rise in three branches or watersheds, known as the north, middle and south forks, and it is the very high efficiency power development of its watershed that forms the basis of the power system about to be described.

The Original Development.

The sensational discovery and development of rich gold mines at Tonopah and Goldfield in the State of Nevada in 1904 created a concentrated market for the sale of electrical energy and it was with this outlet in view that a company was formed to develop the nearest dependable water power, something over 100 miles distant, which resulted in the first plant to be installed on Bishop creek. In 1905 the powerhouse then installed, now known and consisting of a part of power plant No. 4, was looked upon as a very daring venture. A transmission line was built, crossing the Owens valley, thence over the White mountain range through a pass at an altitude of 10,000 ft., thence crossing several valleys and mountain ranges, all desert country and finally branching to reach the two cities above named. This plant consisting of two 750 kw. machines was soon loaded and the powerhouse was increased 300 per cent in generating capacity. Another transmission line was built into Nevada and was extended over one hundred miles southward to Rhyolite in the Bullfrog district, incidentally reaching many other mining camps. The possibilities of developing a power business throughout the desert regions and the advances made in the science of electric transmission pointed to the ultimate development of the entire fall in Bishop creek, to form in a series of power plants a system of unusual economy and efficiency.



Profile of Relative Position of Plants.

Hillside Reservoir and Dam at Left. No. 1 Reservoir at Lake Sabrina on Top and at Right.

Sierra Nevada streams are unique in possessing short rivers having rapid falls, thus making possible the development of large powers with a comparatively small quantity of water. The streams on the eastern slope of the Sierra Nevadas are much more characteristic in this feature than those of the western slopes. Bishop creek has a mean length before it emerges from its canyon of about 14 miles and in this distance the fall is 5,500 ft., or nearly 400 ft. to the mile. The depth of the canyon walls is in most places about 1,000 feet. It became a matter of engineering study to determine the number of power plants which could in the most economical manner, be placed in tandem to utilize the mean-maximum flow possibility of the watershed. This number was fixed at seven, and the plants known as "A" and the numbers one to six.

As the business in Nevada developed the plant development kept pace. After the first plant, which was No. 4, came No. 5, built in 1907, a much smaller but low cost plant. Then No. 2 followed in 1908, a most ideal example of pure Western practice of its time. The company so far, known as the Nevada-California Power Company, had kept pace with its market for its power, but by reaching further the full development of the watershed was foreseen as a good business possibility.

In 1911, the transmission of power at voltages of over 100,000 having proven perfectly feasible, it was

decided after a careful study of the problem to carry a transmission line southward, passing throughout the length of the fertile Owens valley, thence paralleling the recently completed aqueduct which will carry water from the Owens river to the city of Los Angeles, passing through Rose Springs valley, Indian Wells valley, thence through the Randsburg mining district, across the Mojave desert, and finally crossing the San Bernardino range to the city and valley of the same name, a distance of 239 miles. The desert country with a few exceptions where immediate sale for power was possible, was at least a promising field for power development, but the San Bernardino valley with its cities of San Bernardino, Riverside, Redlands, Corona and many smaller towns and a vast area of country, was a prolific field to form a sure power market. In order to carry forward this immense project and complete the power plant developments, a new company was formed and this, the Southern Sierras Power Company is the subject of interest in this description, although it will be advisable to describe the plants of the older company in order to give a comprehensive idea of the chain of power plants which extract from the fall of water each in their turn, all of the power made available by nature.

When it was determined to reach the prosperous and highly cultivated district South of the San Bernardino range to find a market for the newer power plants on Bishop creek, the transmission of this power so great a distance was recognized as being not only a problem of engineering of the most advanced type to merely accomplish the object, but also one in commercial engineering of no mean magnitude. For this district, which includes cities and many towns, was one of the first to enjoy the advantages of electricity and the service requirement on which to build a successful business is rigid. The powerhouse system is complete and carefully designed to meet the very wide service conditions in an enormously scattered territory. The transmission system represents the last word not only in modern design, but in particular detail, and the last precaution has been taken in the installation of the steam plant at San Bernardino, which has sufficient capacity to carry the greater part of the load in an emergency and perform valuable service in regulation at all times.

Characteristics.

At the present time this system becomes interesting to engineers and the general field of modern engineering due to four well defined characteristics.

The efficiency of transmission, and the load factor, are uncommonly high and the cost of operation is unusually low. The former at 80 per cent load factor shows a loss of 18 per cent, while the latter is but 18 per cent of the gross, an unusual coincidence.

The efficiency of the watershed is, or will be, 100 per cent effective. The water after leaving the storage reservoirs, does not follow in the natural waterway until utilized by the last plant from whence it is discharged into an irrigation system.

The transmission line, which is the spectacular feature of the system, is one of the longest, if not the longest, straight-away line, built for the highest commercial voltage yet to be used, using steel-aluminum conductors and being throughout of unique design, forming a new step in the advance of power transmission practice.

Throughout, standards of design have been adopted which show a careful thought and a thorough understanding of the many intricate problems incident to the development of such a system. A fearlessness in good engineering common sense to get the best results with a freedom of methods so successful in the best types of so-called "Western" practice and without a feeling that it is necessary to follow precedent which at other places and under differing conditions might be good practice, but which has been the cause of much financial waste and indifferent engineering results in other points on the Pacific Coast as well as elsewhere.

It is proposed, in this article, to describe the power plants and distributing systems, leaving the transmission line as being of sufficient interest to form the subject of a separate and special article.

Storage Reservoirs.

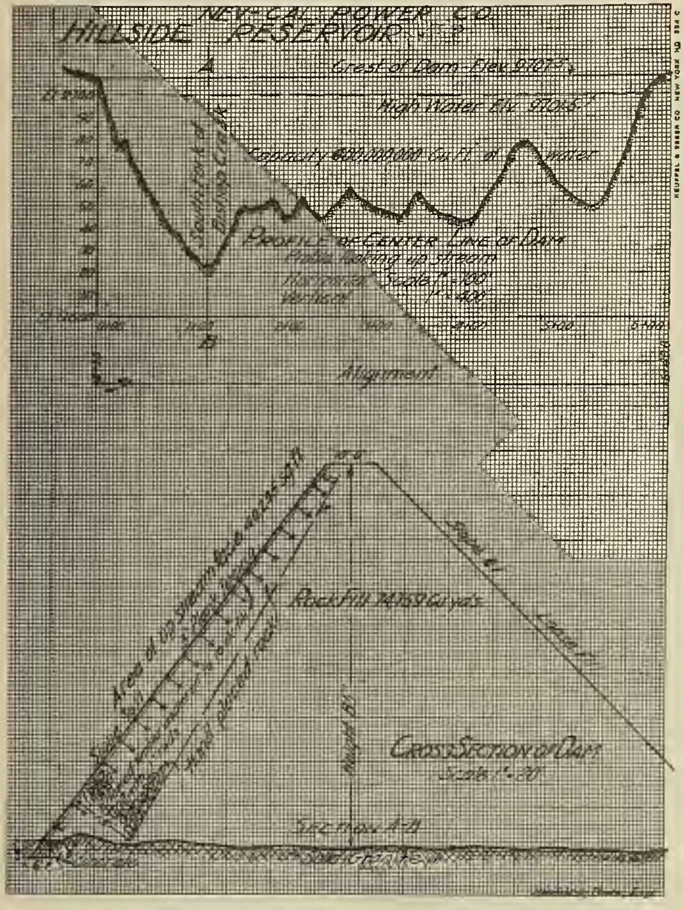
The watershed area of Bishop creek available to the storage and power system is about 39 square miles and lies between the altitudes above sea level of 9,000 and 13,000 ft., the higher altitude being the summit ridge of the Sierra Nevada range. The maximum flood flow which occurs in the late spring will ordinarily reach 500 cu. ft. per sec., while the minimum which occurs between November and March becomes as low as 30 second feet. In order to give a mean requirement for the power system, there are possible three storage reservoirs above the first point of intake for the power plants. Two of these reservoirs have been developed, the one on the south fork known as the Hillside reservoir and the other on the middle fork, popularly known as Lake Sabrina but officially known as No. 1 reservoir. Both of these reservoirs were natural lakes which nestled at the heads of their respective canyons surrounded by the almost vertical cliffs reaching far above to the jagged minarets and glaciered crevices of the granite peaks. The third reservoir is to be similarly placed in the north fork and upon the completion of this storage, the maximum mean flow possibility available from the watershed will have been obtained.

There is available, coming from the three forks of Bishop creek, and to be eventually first used through No. 1 power plant, a continuous flow of 126 cu. ft. of water per second. It is with this flow capacity in view that the design of the power plants has been made. At present until the north fork storage shall have been created, the maximum minimum flow is about 90 cu. ft. per second, although for a part of each year the eventual maximum minimum of the system is readily available.

Hillside Reservoir.

Originally a deep natural lake, a low dam was built some years ago by the Hillside Water Co., giving a small added capacity. Upon purchase by the present owners this low dam was abandoned and a new and much higher dam was built creating a capacity, includ-

ing that available from the natural lake, of 600 million cu. ft. At some future date it is proposed to increase the height of this dam by 30 ft. The dam is a loose rock fill type, it has a length not including the spillway of 650 ft. and the greatest height is 85 ft. The crest has a width of 15 ft. The downstream face has a slope of 1¼ horizontal to one vertical,



Profile and Cross-Section of Hillside Dam.

and this face is smoothly finished with hand placed rock. The upstream or water face has a slope of ¾ horizontal to one vertical and has a timber lining. In placing this lining, the local lodge-pole pine timbers, peeled and hewed flat on one side, were placed in the rock surface of the dam. These timbers are held in place by 1 in. iron bolts, 6 ft. long and spaced 5 ft. apart. These bolts extend into the structure of the dam and a "U" turn at the extremity of the bolt serves to form an anchor. The timber lining consists of 3 x 12 in. sawn planks laid horizontally and spiked to the timber sills. For the lower one-third of the height of the dam face there are three layers of lining planks, and between the first and second layer is placed a layer of tarred heavy sail cloth to act as a water check. The second third of the face has two layers of planking between which is placed the waterproofing, while the upper third has but one layer, part of which are 2 x 12 in. planks. At the southern extremity a cut through a natural spur in the granite bedrock forms a wasteway, 40 ft. long. A curiosity here presents itself in that the weir edge of the wasteway is a sharp edge of the ledge which broke out while excavating for the wasteway, leaving a natural weir, level and at the proper height.

For the purpose of drawing out the water, there are two 24 in. sheet steel pipes extending from well into the reservoir, and carried through the base of the dam into a small concrete building at the lower toe. This building contains two gate valves by which the water through the outlet pipes is regulated. The building has a heavy timber roof to resist the weight of snow which it may be called upon to carry and the gates themselves are well surrounded and packed with manure to prevent the possibility of freezing. The altitude of the crest of the dam is 9,707.5 ft.

This dam is similar to many rock filled dams in California, and, except for its size might not be of especial interest. The method of getting water out of the natural lake, after its surface has fallen below the bottom of the dam, and the means by which this was accomplished will undoubtedly be of interest.

The Outlet Tunnel.

There is a ridge of rock extending from the center of the dam back toward the center of the natural lake. It was proposed to start a tunnel at a point 600 ft. below the dam in a ridge which is the continuation downstream of the ridge in the lake. It was proposed to carry this tunnel a distance of 2,000 ft., sloping upward 10 ft. in its length and tapping the natural lake at a point 1400 ft. above the dam and at an elevation 65 ft. below its base, practically at the bottom of the natural lake. It was further proposed that this tunnel, being supported on both sides between the hillside, should have a control gate at its lower extremity and hence be under pressure from the lake with a possible pressure head of 140 ft. An interesting problem presented itself from the fact that the tunnel must be put through into the lake and at the same time conserve the water therein which, of course, had no other means of escape.

Work on the tunnel was successfully carried forward in the ordinary manner. At 135 ft. from the entrance, an adit was driven. When the work had progressed until but a few feet remained between the workmen and water in the lake, and when through seams in the granite, water began to percolate, it was deemed the proper point to make the final move. A 36 in. pipe 36 ft. long was laid in the adit and the opening closed around the pipe by a heavy concrete filling. On the end of this pipe was placed a 36 in. gate valve for the control of the water. In the branch tunnel to the adit there was placed a trap gate. This consisted of an iron frame fitted into and cemented in the bore. To this was hinged, so as to swing horizontally from the inside, a heavy steel door. This door was held open against the roof of the tunnel by a wire rope run over a pulley fixed in the roof of the tunnel and then through a 1 in. pipe cemented into the ceiling wall past the gate frame, thence over another pulley through a small vertical shaft to the surface where a winch was set to wind the rope and raise the trap gate. At the lake end of the tunnel a cross gallery was cut and after very carefully calculating the amount of rock to be moved, on the assumption that it was solid, and

giving an ample factor of safety, the galleries were loaded with part 40 per cent dynamite and the remainder black blasting powder. The tunnel was then tamped to a thickness of 20 ft., using the muck of the excavation. In order that the tamping would be loosened and removed to prevent its clogging the tunnel after the blast, a considerable charge was placed with the tamping and timed to fire slightly after the main charge. The charges were wired for battery firing and were also fused, the fuses being carried through the tunnel. The gate valve was opened and the trap valve was also raised and the man in charge of the latter was instructed to listen at the mouth of the adit, after the explosion had taken place, until he could hear the rush of water and then to immediately spring the trap valve and close the gate valve as soon as the water should start. The battery firing was successful as well as the firing of tho tamping charge. The trap valve was closed and the tunnel was put through into the lake. The opening was so thoroughly made, however, that it became necessary to erect a considerable timber structure at the mouth of the tunnel to support emergency gates placed there in case the tunnel or outlet gates should for any reason fail.

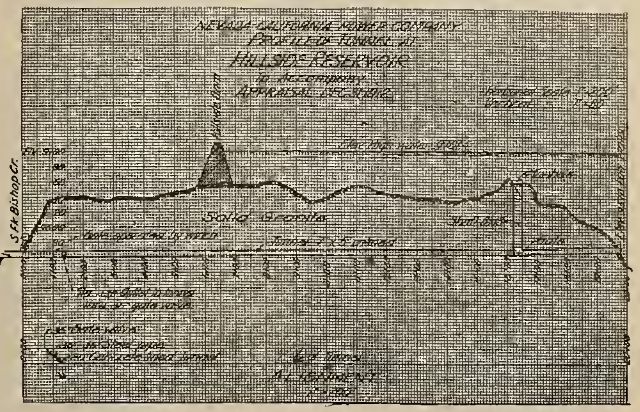
No. 1 Reservoir.

No. 1 reservoir, locally known as Lake Sabrina, was the first completed with a dam. Situated very much as is the Hillside reservoir but on the middle fork, its elevation is somewhat lower, being 9,079 ft. at the crest of the dam. The dam here has a length including the spillway of 1,065 ft. and a maximum height of 75 ft. The construction of the dam is similar in every respect to the one already described. The spillway is of concrete, it has a length of 40 ft., and the weir has an ogee section. Three 24 in. steel outlet pipes terminate in gate valves at the lower toe of the dam and these are placed within a concrete building similar to the one described. There is no outlet to the natural lake as is the case with the Hillside reservoir.

It is with the outlet pipes of this dam that the flow line for the first power plant is to commence and this flow line, which, following the precedent in the entire design of this system, will consist of wood stave pipe and will be carried along the south hillside of the middle fork to a point near where the south and middle forks join. Here a pressure pipe diagonally down the hillside will connect with the first powerhouse of this system.

No. 1 reservoir when full covers an area of 159 acres, and the capacity is 300 million cu. ft. The dam contains 50,000 cu. yds. of rock fill.

The Hillside reservoir is about seven miles above the junction of the south and middle forks, and its water will be carried from the dam outlet through a wooden pipe flow-line along the north slope of the south fork to a point where it may be dropped through a pressure pipe to proposed plant "A." From the tailrace of this plant the flow will continue through a wooden pipe line to plant No. 1. This plant will necessarily have two pressure pipe lines as the head available from the No. 1 reservoir will be 950 ft., while that on the Hillside pipe will be 850 ft. At the present the "A" and No. 1 plants are the only ones of the total of seven plants possible on the creek which have not been developed. The elevation of No. 1 power house will be 8,050 ft., making it the highest



Profile of Hillside Reservoir Tunnel.

in point of altitude of any Pacific Coast plant. At present, water from the Hillside reservoir runs down the South fork to a simple diversion and from this point is carried in a steel pipe line, 8,000 ft. long, being part 34 in. and part 38 in. diameter, discharging into the forebay reservoir of No. 2 power plant.

The Power Plants.

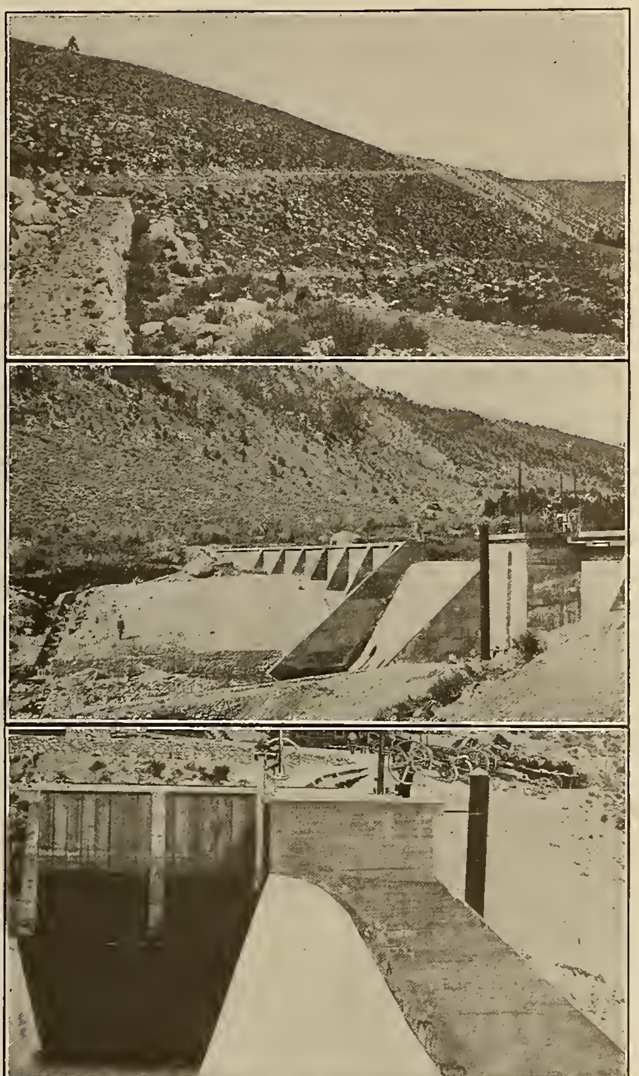
The first plant to be completed by the Southern Sierras Power Company has been No. 6, which was placed in operation in March of the present year. Simultaneously No. 3 has been developed and was placed in operation about one month after No. 6. There now remains, as already stated, but one, No. 1, to be developed, although still higher up there is a possibility of installing a small plant, which, if built, will be known as plant "A".

Beginning at a point in the middle fork, somewhat above the junction with the south fork, and where the No. 1 power house will be placed, there has been built across the creek an earth fill dam with concrete core wall. In the center of this dam is a concrete ogee weir having at its toe a water cushion. The weir has a length crest of 40 ft. and is 30 ft. high. The dam forms a pond and balancing reservoir for No. 2 plant. The intake consists of a concrete box set somewhat back from the dam within the reservoir. This is open at both ends, each opening being covered by a screen of vertical steel bars, ¼ in. thick and 3 in. wide, placed side by side and spaced 1 in. apart. The conduit line to plant No. 2 is carried through the dam and enters the intake box, its opening being controlled by a sluice gate operated from above through a bevel hand gear. At both ends of the concrete spillway, level with its lowest point, are sluice openings controlled with 36 in. sluice gates, operated from the top of the dam through inclined stems.

A peculiarity of this system is found in the fact that the water is carried entirely in either gravity flow or pressure pipes, there being no open canal, ditch or tunnel as is the case with almost any other California power system. This has been done for the threefold purpose of conserving water, getting the benefit

of regulation from the intake reservoirs and the prevention of introducing snow or ice in the conduit lines, a very necessary precaution in this high altitude.

The No. 2 conduit system consists of 10,025 ft. of 48 in. redwood stave pipe. This pipe is formed from $5\frac{1}{2} \times 1\frac{5}{8}$ in. timber and is held together by $\frac{1}{2}$ in. round bands. The pipe is laid approximately to the hydraulic grade when passing the full quantity



Flowline of No. 2 Power Plant.
Intake of No. 2 Power Plant.
Concrete Ogee Weir.

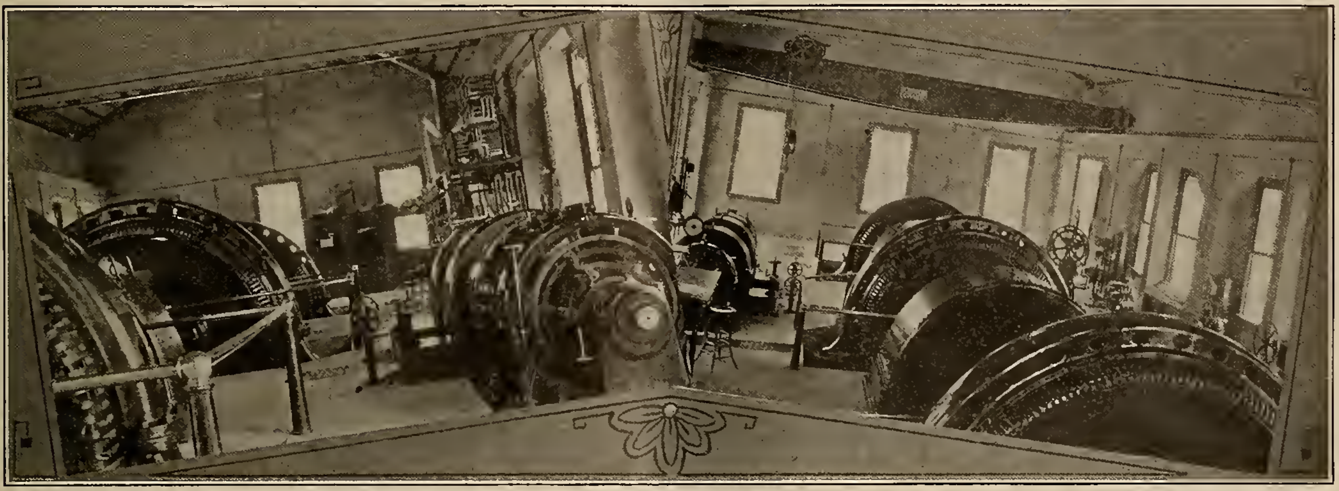
of water, and has a static head to the end of the flow section of 70 ft. In laying, the side hill was carefully benched off and leveled and after finishing, dry rock walls were built on either side and the pipe was covered with earth, at least one foot thick all around. This has been found sufficient to prevent freezing and at the same time keeps the pipe damp and prevents decay to any appreciable extent. This pipe was furnished by the Redwood Manufacturing Company. The stave pipe ends at a point where its grade brings it to the top of the ridge. The pipe is now continued down the side hill to power house No. 2. The pressure pipe has a diameter of 48 in., the lower part is butt and strap riveted and the thickness varies from 3-16 in. at the upper end to 7-8 in. at the power house. There are a number of concrete anchorage blocks. At the junction between the wood stave and the steel pressure pipe, there is placed a standpipe. This is of riveted sheet steel, 3-16 in. thick, has a diameter of 48 in., and a height of 80 ft. It is strongly guyed and an iron ladder is fastened to it by which the top may be readily reached. The static head at the water wheel nozzles is 938 ft.

It should be noted that throughout, while building materials, especially cement, has in no way been stinted, the various structural designs have been carefully worked out to give a maximum of strength and efficiency with a minimum of material. This is due to the high cost of the latter, there having been times when it was necessary to haul cement, a bag at a time on a sled, three or four men furnishing the tractive power.

No. 2 powerhouse, in its design, represents a style of construction and finish characteristic of all of the plants with the exception of No. 5. The building is of reinforced concrete. There are four columns on each longitudinal side of this construction, these extend inside of the walls and support the crane rails, also of concrete, and extend without the walls to give a buttress effect. Curtain walls between the columns are 6 in. thick. The end walls have two buttressed columns and the walls are carried to the gables, which are finished above the roof in a simple style of the Spanish rennaissance. The roof is supported on three Fink steel trusses, the purlins being "I" beams spaced rather closer than usual and carrying a steel Spanish tile roof. The powerhouse layout is very simple and consists of three main generating units placed with their shafts in a line lengthwise of the building. The generators furnished by the Westinghouse Electric & Manufacturing Co., are rated at 2,000 kw., and deliver three-phase current at 2200 volts. The speed is 300 r.p.m. The generators are mounted in pits and there are but two bearings, the waterwheels being overhung. One of these machines installed at a later date than the others is of slightly different type, being somewhat more refined in outline and the rotor hub being made of built up steel plate. The two earlier units are driven by single runner Pelton water wheels, each equipped with needle deflecting nozzles controlled by hand operated worm-gear hand wheels. Pelton governors with self contained oil tanks control the nozzle movement and are operated, each by a 3 h.p. 300 r.p.m. General Electric induction motor. On the feeder pipes which enter the building at an angle below the floor, there being one for each unit, are Pelton gate-valves operated by reversible water wheels. The third unit is driven by a Doble wheel, also equipped with needle main and auxiliary nozzles. A Doble 22 in. gate valve driven by a reversible motor controls the water flow and a Lombard type "Q" governor controls the nozzle mechanism. A Lombard automatic oil pump driven through a Morse chain by a General Electric 5 h.p. 900 r.p.m., motor furnishes oil under pressure to the governor.

Placed in front of two of the main units and with their shafts in line are the two exciter units. The generators in both cases are Westinghouse, 100 kw.,

6-pole d.c. machines, operating at 580 r.p.m., and delivering current at 125 volts. The waterwheels are Pelton single overhung runners with hand operated needle nozzles and cast iron housings. One of the units has a Westinghouse 140 h.p., 2200 volt induction motor placed between the water wheel and the generator, there being one bearing between the water wheel and the motor and another at the far side of the generator. With the first unit the two generator bearings furnish the only shaft support. A single cylinder air compressor driven by a 3 h.p. induction motor furnishes compressed air for cleaning. The switchboard is placed at the middle of one side of the building facing the main units. It consists of three generator panels and an excited panel of blue Vermont marble and a detached panel controlling the exciter motor. Westinghouse standard round type instruments are mounted on the panels and on arms at either end of the switchboard. The generator switches are mounted on the back of the respective panels. All wiring is carried in ducts under the floor.



Interior Views From Opposite Directions in No. 2 Powerhouse.

No. 2. Powerplant, Showing Powerhouse and Transformer House; Flowline and Standpipe on Top of Hill; No. 3 Intake in Foreground Under Construction.

The transformers are housed in a separate building of similar construction to that of the power house. It is 63 x 25 ft. and is placed at right angles in relation to the main building. Within the building, mounted on concrete rails about 18 in. above the floor and placed in a line are 7 1,000 kw. Westinghouse oil insulated and water cooled raising transformers, one being a spare. These are wound for 2200 volts primary to 30,000 volts secondary and are star connected

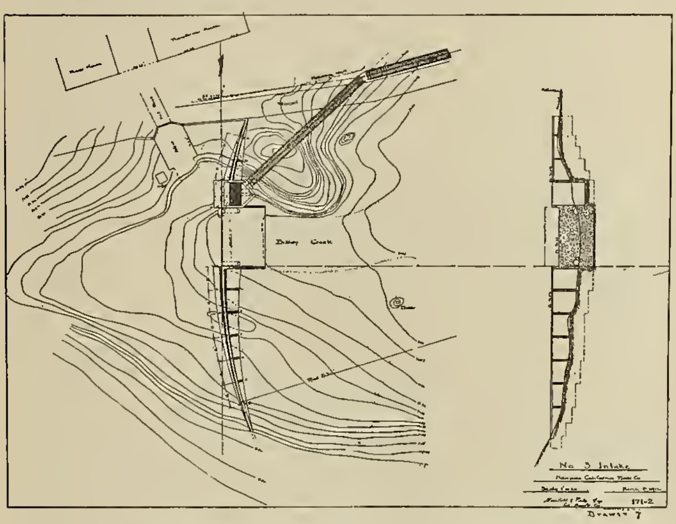
on the high tension side for 55,000 volts. Paralleling the line of transformers is a track on which runs a transfer car onto which any transformer may be moved and transferred. This method of handling transformers is consistently maintained at all points of the system.

Two sets of Pacific Electric Company's 60,000 volt oil switches are mounted on reinforced concrete platforms placed over the transfer track and from these the lines pass through window openings to the pole line of the Nevada-California system.

The water discharge from this plant from a tail race under the power house floor passes directly to the pond in the creek bed created by the dam and intake for the No. 3 installation. The elevation of this intake is 7,093 ft. above sea level.

Power Plant No. 3.

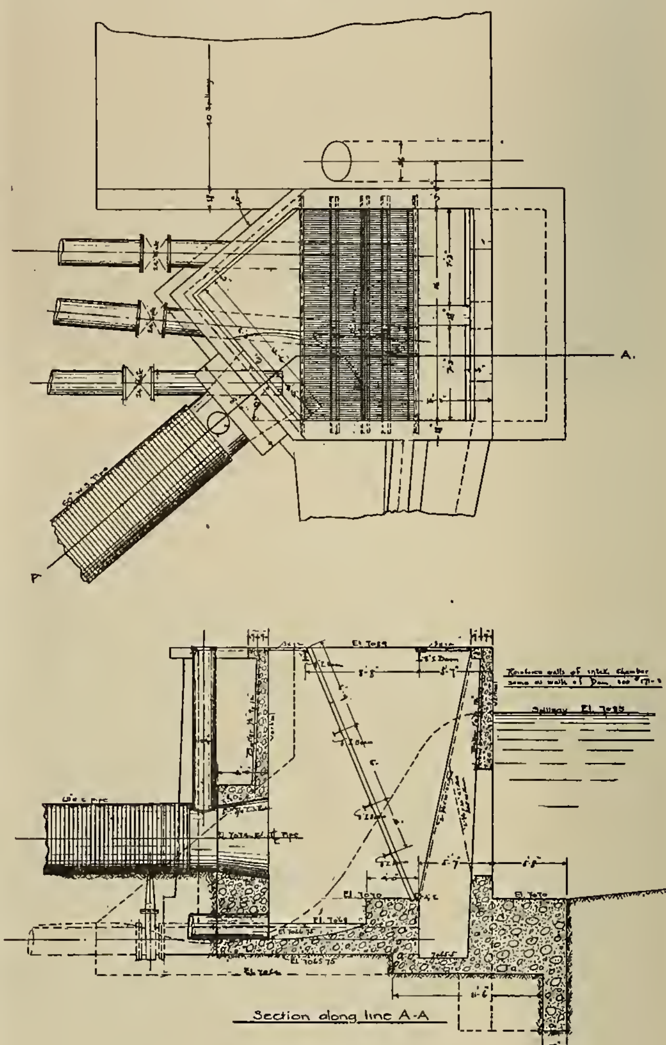
The intake dam, which, at the present is nearing completion, except that it is somewhat smaller, due to the narrowness of the creek at this point, will be like the three intake dams for the plants lower down, to be later described.



Plan and Elevation of No. 3 Intake Dam.

Like No. 2 pipe system, the No. 3 pipe is a redwood stave construction, but somewhat larger, being 60 in. inside diameter. The bands are 5-8 in. The flow section has a length of 13,500 ft. and is packed in earth with a rock siding similar to No. 2 pipe. The grade is 4 ft. per 1000 ft., giving the greatest static head as 64 ft. At the end of the wood section is a riveted steel standpipe, 54 in. diameter and 80 ft. high. This has an iron ladder to its upper extremity and is thoroughly braced with steel cables. With a flow of 150 second-feet, the pipe lies at the hydraulic grade. At a distance of 12,000 ft. from the intake there has been placed a surge pipe laid at right angles following the slope of the hill above the flow pipe, which is about 30 degrees with the horizontal. This surge pipe has a diameter of 60 in. and is built of 3-16 in. and ¼ in. steel plates. The pressure pipe has a length of 4630 ft. It is of riveted and butt and strap riveted steel in three diameters. At the upper end the pipe has a diameter of 54 in., and a thickness of 3-16 in. The diameter reduces to 50 in., and finally to 48 in., the thickness at the bottom being ¾ in. The static head at the water wheels is 814 ft., while the effective head under full load is 730 ft.

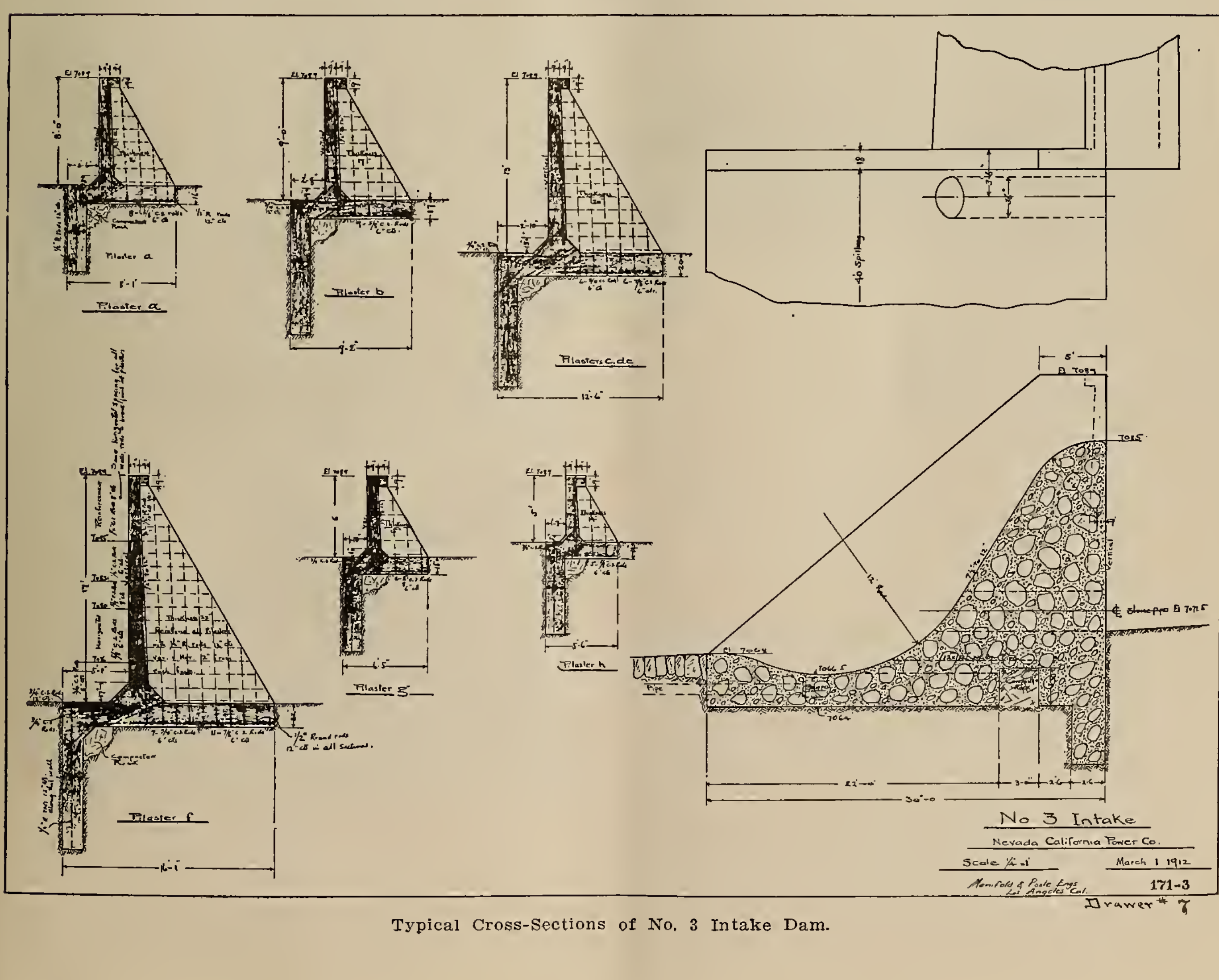
The No. 3 powerhouse is almost a replica of No. 2, both in the laying out of machinery and in the style and type of building. The dimensions of the building inside are 38½x82 ft. There are five pilasters, including the corners on each side and two in each end, and the roof is supported on four Fink trusses and consists of galvanized corrugated iron, with two round ventilators in the ridge. There are



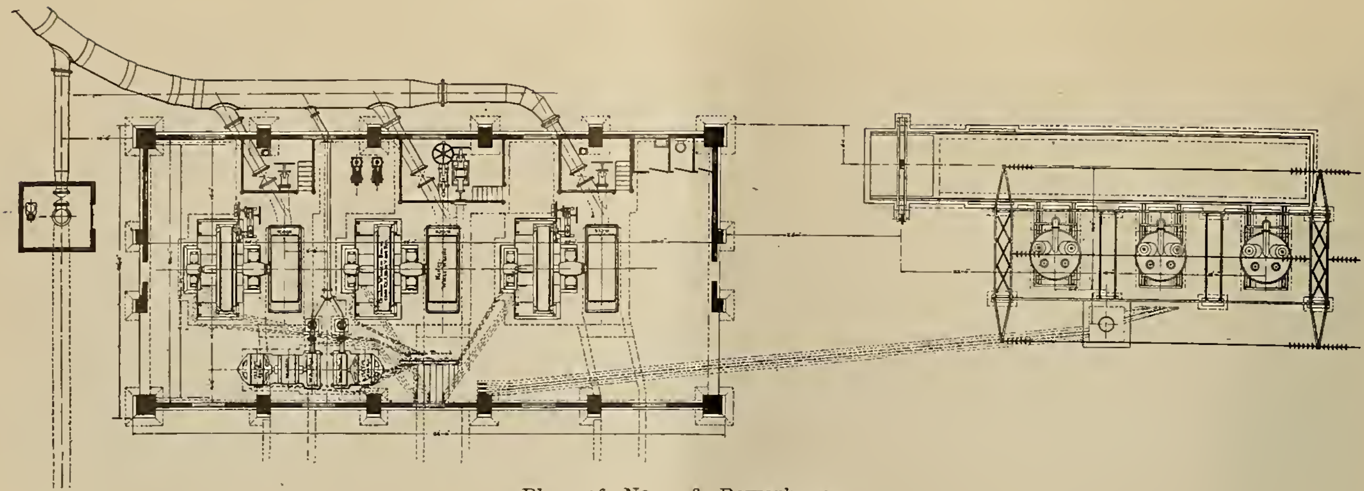
Intake Box for No. 3 Powerhouse Pipeline.

three main generating units, each having a rating of 2250 k.v.a. The generators are Crocker-Wheeler, two bearing, 3-phase, 2200 volt machines operating at 300 r.p.m. They are driven by single overhung runner waterwheels known as the "Henry" type, designed and built by Geo. J. Henry of San Francisco, formerly engineer for the Pelton Water Wheel Company. Stationary needle nozzles are operated on the two end units with hand control. On the middle unit, the needle is operated by Henry's patented automatic, oil-pressure operated control and in conjunction with this is a similarly operated automatic bypass. These automatics obtain their movement by a cylinder mounted in line with the nozzle and bypass pistons, in which oil under a pressure of 100 lbs. is supplied from a water operated pair of steam pumps with necessary reservoirs, piping, etc.

No. 3 Power Plant. Flowline Is Shown in Center Background, the Flowline for No. 2 Plant Is in Left Background.

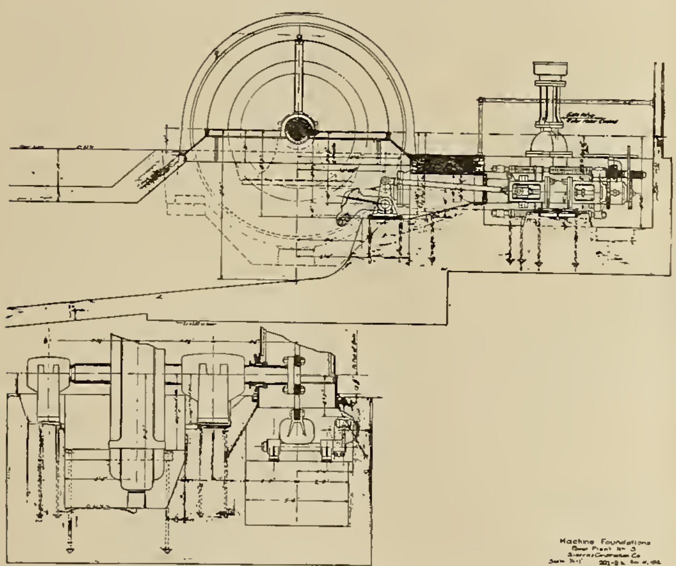


Typical Cross-Sections of No. 3 Intake Dam.



Plan of No. 3 Powerhouse.

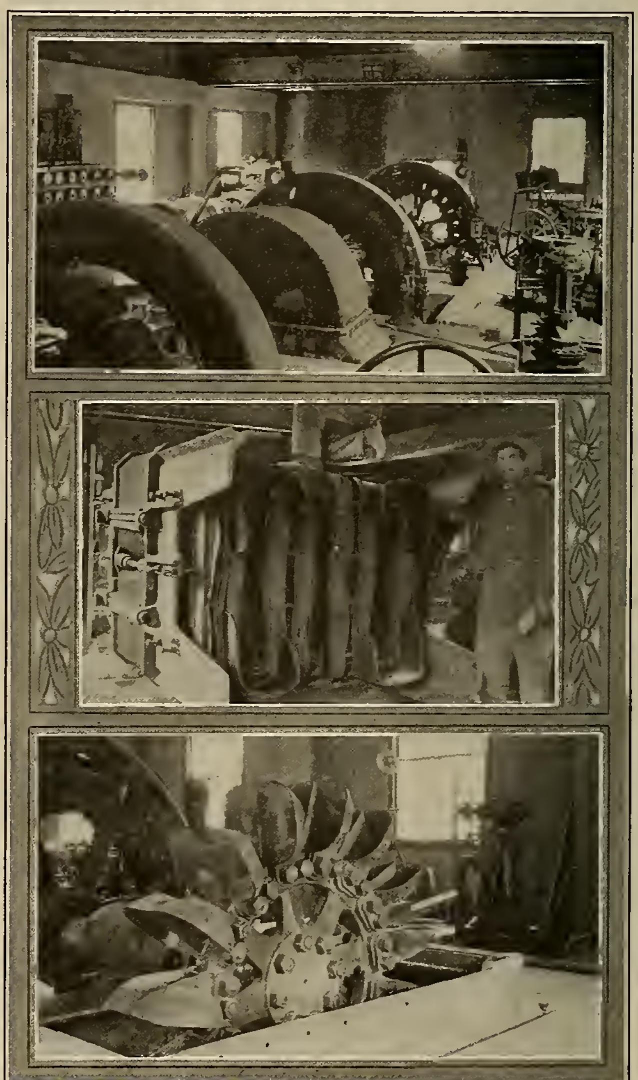
It has been the policy of this company to avoid automatic regulating devices both on the hydraulic and electrical parts of the system, with the exception of the speed regulating governors. The water flow variation is but slight from day to day and in operating the chain of plants practically no sudden change can be made in the water quantity. For this reason there is little need for the added expense of automatic hydraulic regulation. No. 3 being the most modern plant, an automatic water saving device was installed on one unit to be used only in the case that through some interruption the flow might be materially reduced and the saving of water at this point become a necessity.



Cross-Section and Elevation of Main Generating Unit at No. 3 Powerhouse.

The governors on units one and three are Lombard type "M" which operate balanced deflecting hoods over the nozzle streams. On the center unit is mounted a Woodward governor which operates in conjunction with the automatic nozzle and bypass described.

There are two exciter sets placed in line with the switchboard close to the building wall. These have Crocker-Wheeler, 6-pole and interpole, 125 volt d.c. generators operating at 580 r.p.m. and are driven by single runner overhung Henry water wheels equipped with hand regulated needle nozzles. One of the units is quipped with a 150 h.p., 2200 volt, 3-phase, Crocker-Wheeler induction motor between the water wheel and the generator, and connected to the latter through a bolted coupling. Both units have two bearings.



Interior of No. 3 Powerhouse: Underneath View Showing Coil Ends and Insulation of Westinghouse Transformer at No. 3 Powerhouse. Henry Waterwheel on Main Unit, No. 3 Powerhouse.

On each of the main feed pipes, which enter the building on an angle below the floor level, are 24 in. steel gate valves operated by reversible water motors. These gates were built by the Main Street Iron Works of San Francisco.

The switchboard in five panels was furnished by the Crocker-Wheeler Company and is equipped with Westinghouse instruments and Condit oil circuit breakers mounted separate from and in the rear of the switchboard. These switches are equipped with time limit relays and automatic trips. These features are, however, disconnected and not used in operating the plant.

suspended from the cross beams. By means of this device a transformer may be let down into the pit and the core removed or inserted as the occasion may require. Over the transformers is erected an extensive angle iron framework. Opposite each transformer on the rear side are mounted on the framework the high tension disconnecting switches and on the front one those for the low tension circuits. On top of the frame is a set of 3-pole Bowie air break switches with hand control from below. From these switches the circuit is carried to a three wire steel "Wishbone" pole line which goes to the control station at the mouth of the canyon.

General View of No. 4 Powerplant.

The oil pressure system, which is novel, is operated by two Dow steam pumps with cylinders 6x4x6 in., having enlarged ports and using water from the auxiliary pipe supplied from a redwood tank which in turn is filled through an automatic valve from the main pipe line.

This plant will be operated on the system of the Southern Sierras Power Company and the transformers and high tension apparatus follow the standards adopted. All of this apparatus is "out-door" type and is placed adjacent to the power house. There are 3 Westinghouse, water-cooled transformers wound 2200 to 87,000 volts and to be star connected on the high tension side for 140,000 volts. These are mounted on I beam trucks with 12 in. cast iron wheels and stand on raised concrete platforms. A steel transfer car on an 8 ft. gauge track parallels the transformers. At the end of this track is a concrete lined pit, 16 ft. deep, over which is a steel gallows frame made of 6 in. H beam columns and two 15 in. I beam cross bars with corner braces. A hand winch operates a wire rope tackle with double 3 sheave blocks,

The discharge from this station, like No. 2, is into the forebay pond formed by the concrete dam of No. 4 intake. The elevation of this intake is 6,220 ft.

Power House No. 4.

Approaching the canyon from the town of Bishop, one rides some four miles between rich fields of alfalfa and more directly between stately rows of poplars before the first slope which is soon to rise very abruptly toward the mountain peaks, is reached. Another mile and the chauffeur (if you are so fortunate as to be riding in an auto.) puts in the intermediate gear, although the country looks fairly level, but the trees are missing and the granite boulders are thick among the clumps of sagebrush. The canyon is entered between two abrupt hills that would look very high were they not dwarfed by the snow covered peaks which seem to rise directly behind them. About a mile ahead as one looks up the canyon there appears a large and picturesque group of buildings, their red and green roofs interspersed with trees and shrubbery, a very bright and inviting spot nestled into a

turn of the towering canyon. One might easily imagine it to be a well ordered summer watering place. The grounds are entered through a quaint lodge gate and the macadamized and concrete parapeted road lined with tasty electroliers divides, passing around both sides of the canyon to meet in a wide sweep above the buildings. The creek, rocky and precipitous, has been confined between heavy concrete walls, as is done in the Swiss Alps, and where it widens in the center of this settlement, a sort of sunken garden, a triumph of the landscape artist, forms an island which dips into the little lake below it. And all this, because in its midst is No. 4 power plant, the first and oldest in this remarkable chain of plants.

The concrete dam which forms the intake for plant No. 4 is representative of the type of dam used throughout, although not so modern in some minor details as the dam for No. 6 plant, described later. The dam consists of a reinforced concrete vertical wall 12 in. thick at the top, increasing downward to 15 in. On the top is a coping 18 in. wide, being flush with the wall on the upper side. The dam is supported from overturning by triangular buttresses 12 in. thick with a 2:1 slope on the buttress face. The buttresses are spaced about 20 ft. apart. In the center is an ogee spillway having a crest 24 ft. above the bottom and 50 ft. long. The height of the dam coping is 29 ft. Placed in the dam between the spillway and the north end is a concrete intake box. This is open at one side, the opening being covered with a sloping grizzly of 3x¼ in. steel bars placed on edge and spaced 1 in. centers. There are two 5 x 5 ft. sluice gates to control the flow into the pipe. Directly in front of the pipe opening inside the box is a flat iron gate hinged to one side of the pipe and operated by a worm gear and hand wheel. This is called a slap-gate, and in case of emergency, by pulling a pin, the force of water will slam this gate closed over the pipe opening. The usual pair of drain gates are also provided at either end of the weir.

The flow line is a 42 in. redwood stave pipe 6700 ft. long. From this two steel pipe lines are carried to the powerhouse by different routes. The first pipe installed is 24 in. diameter and is 5,000 ft. long. This pipe is lap welded steel and was imported from Germany. It varies in thickness from ¼ in. at the top to ⅝ in. at the power house. There is a 12 in. standpipe 65 ft. high at its upper end. The newer pipe was given a different route, keeping well away from the first for the sake of safety and thus has a greater length. This pipe is riveted sheet steel, the lower sections having butt and strap joints. The diameter is 30 in. and the thickness varies from 3-16 to ⅝ in. The pipe is well anchored by cyclopean concrete blocks placed in the construction bell holes. There is a 30 in. standpipe at the top. This pipe was built by Schaw, Batcher Co., of Sacramento. Close to the power house the pipe lines are connected through a small header, but the water wheel connections are made directly from the branches in either line. The effective head at the water wheel nozzles is 1,050 ft., while the static head is 1,120 ft.

The power house building, while it has been added to to accommodate increased capacity, is substantially in construction like those of Nos. 2 and 3, being of reinforced column and curtain wall type, with corrugated iron roof of Fink steel trusses. There is a main bay for the generating units and a gable addition forming a bay almost as long as the main part, in which are placed the transformers. There are five main generating units placed with their shafts in line. The first two units have 750 kw. National Electric Co. generators, operating at 450 r.p.m. and delivering 3-phase current at 2200 volts. These units have two bearings mounted on the castiron generator base frame. The waterwheels are single runner overhung, built by the Pelton Company. They have hand control needle nozzles which regulate by deflecting and are operated by Sturgiss governors. On each intake pipe, which connects to the older pipe line, are hand operated bevel geared gate valves. The remaining three units are 1,500 kw. Allis-Chalmers generators with two bearings mounted on cast iron base. These operate at 400 r.p.m. and like all generators of this system deliver current at 2200 volts. The water wheels are overhung single runners equipped with governor deflecting, hand regulated needle nozzles. The gate valves on the intake pipes are operated by reversible water wheels. While the general specifications of the water wheels on all three machines are alike, two of the water wheels with their gate valves were furnished by Doble, while the third is a Pelton unit. On the new pipe line there is a 30 in. hand-gear operated master gate valve. The three larger units are controlled by Lombard type Q governors. Oil is suppled under pressure for all of the governors by a 3-throw Lombard oil pump driven by a General Electric 10 h.p. induction motor. There are three exciter sets. Two of these have National 60 kw., 140 volt, 850 r.p.m., 6-pole, d.c. generators, with single runner overhung Pelton water wheels equipped with needle nozzles. The latter are controlled by a hand wheel with a left hand screw, installed presumably to insure opening quickly by the natural right hand motion should the nozzle become plugged, but habit and custom are strong guides and this reversal of common practice has at times proved to be annoying if not disastrous. One of these units has a National type I, 90 h.p., 2200 volt induction motor. The third exciter unit has a General Electric 55 kw., 125 volt, d.c. generator operating at 650 r.p.m. with Doble overhung waterwheel having a needle nozzle. The latter is controlled by what is claimed to be the first Replogle governor to be put to regular use. This unit has also one General Electric type I, 75 h.p., 2200 volt induction motor. The switchboard of blue Vermont marble, has five generator panels with oil switches mounted on back, two exciter panels and one voltage regulator panel. A full equipment of Westinghouse instruments follows the general practice of standardizing in use in this system. Back of and above the switchboard, placed on concrete platforms mounted on steel columns, are three sets of Pacific Electric, 60,000 volt oil switches on the high tension circuits from the transformers. There are 7 (one spare) Stanley-G. I., 500 kw. type W., 2200 to 33,000 volt water cooled transformers. Also

3 additional units of same make and capacity, Y connected on the high tension side for 55,000 volts through which the Nevada-California and the Southern Sierras systems are paralleled.

Near the power house is a corrugated iron switch house, 50x35 ft. Two high-tension (33,000 volt) circuits leave one side for the Nevada transmission. One circuit entering each end of the building comes from the power house and a fifth circuit entering the other side connects to plant No. 2. After passing through Pacific Electric oil switches placed on two galleries, the circuits connect to a common bus. Close to the switch house and under the Nevada circuits is a concrete building 30 ft. long and 9 ft. wide, inside measurement, with overhanging roof on one side. This building houses the General Electric aluminum cell electrolytic arresters. The lines to the horn gaps enter the building under the protecting roof through special wall insulators.

There are at this plant a commodious club house and a number of neat and tasty cottages for superintendent and operators and their families.

The elevation of No. 4 plant is 5,156 ft.

Power Plant No. 5.

Mention has already been made of the lake into which the tail water discharging from Plant No. 4 passes, this, as in the plants above, is formed by a

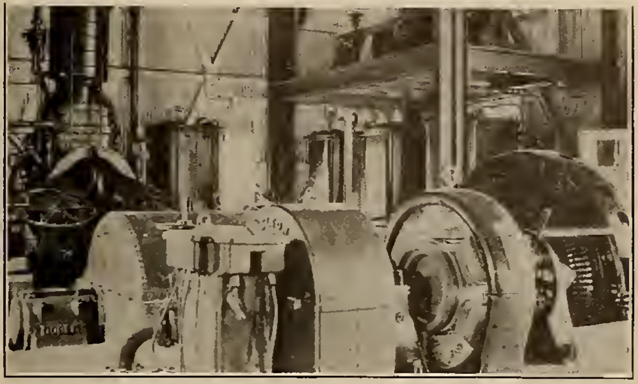
No. 5 Powerhouse and No. 6 Intake.

dam across the canyon which makes the diversion into the pipe line of No. 5 plant. The dam with its ogee spillway weir, intake box, gates, etc., is similar to the one belonging to No. 4 plant, with the difference that it is somewhat longer, and is made of a number of tangent sections to form roughly a curve down stream.

The pipe line, which is covered in the manner typical of this system, is 2,500 ft. long in the flow-line section. This is a fir stave pipe, 54 in. inside diameter. This section terminates at the end of the hill which is in reality the end of the canyon. From this point a riveted sheet steel pressure pipe 42 in. diameter, varying in thickness from 3-16 in. to ½ in., and having a length of 5,500 ft. terminates in powerhouse No. 5. At the top of the steel section is a steel standpipe.

Powerhouse No. 5, which was the second plant to be constructed and is operated in connection with the Nevada-California Company, is a corrugated iron building over a steel frame covering a ground space 40 x 60 ft. It is placed close to the creek, which at this point is between deeply eroded banks forming a ravine or arroyo, and is almost hidden from sight on approaching until one is very close.

There is but one main generating unit with a capacity of 1,500 kw. This is placed in the center of the building, the shaft line parallel with the shorter axis



Interior View of No. 5 Powerhouse.

of the building. The generator furnished by the Allis-Chalmers Company is a standard 2-bearing type mounted on castiron base. It delivers 3-phase current at 2200 volts and operates at 400 r.p.m. The shaft is solid through the waterwheel which has an outboard bearing making three bearings to the unit. The water wheel was built by Doble and has two tangential runners, each furnished with needle nozzles which may be hand or governor operated by the movement of a clutch. The 24 in. intake pipes to the nozzles join back of the water wheels through a Y casting with a 36 in. outlet and between this and the pipeline is placed a 36 in. Platt Iron Works gate valve operated by means of a hydraulic cylinder which takes water from the penstock. Formerly the prime mover for this unit was a Francis type water wheel. This proved unsatisfactory in operation from the fact that the water, while apparently clear and pure, carries much glacial sand and the cost of renewing chutes and runners due to the erosion from this suspended matter resulted in the substitution of wheels of the tangential type. A type Q Lombard governor is in place but not always in use, hand control being often preferred as more economical in the use of water, when no regulation from this station is required. There is one exciter set, having an Allis-Chalmers 60 kw., 120 volt, 600 r.p.m., 6-pole, d.c. generator and a single runner, overhung Pelton tangential water wheel in cast iron housing and hand regulated needle nozzle, all mounted on a cast iron bed-plate. The switchboard is in two panels and is of the same general style found in the other plants. In one corner of the building there are 4, Stanley, G-I, 500 kw., water cooled raising transformers, wound for 2200 to 33,000 volts. (One of these is spare.)

One set of Pacific Electric Manufacturing Company's oil circuit breakers are installed over the transformers on a reinforced concrete platform. No. 5, like the preceding plants, discharges into a pond formed by diverting dam for power house No. 6.

The operating hydraulic head on No. 5 plant is 420 ft. The altitude of the powerhouse is 4,730 ft.

Power House No. 6.

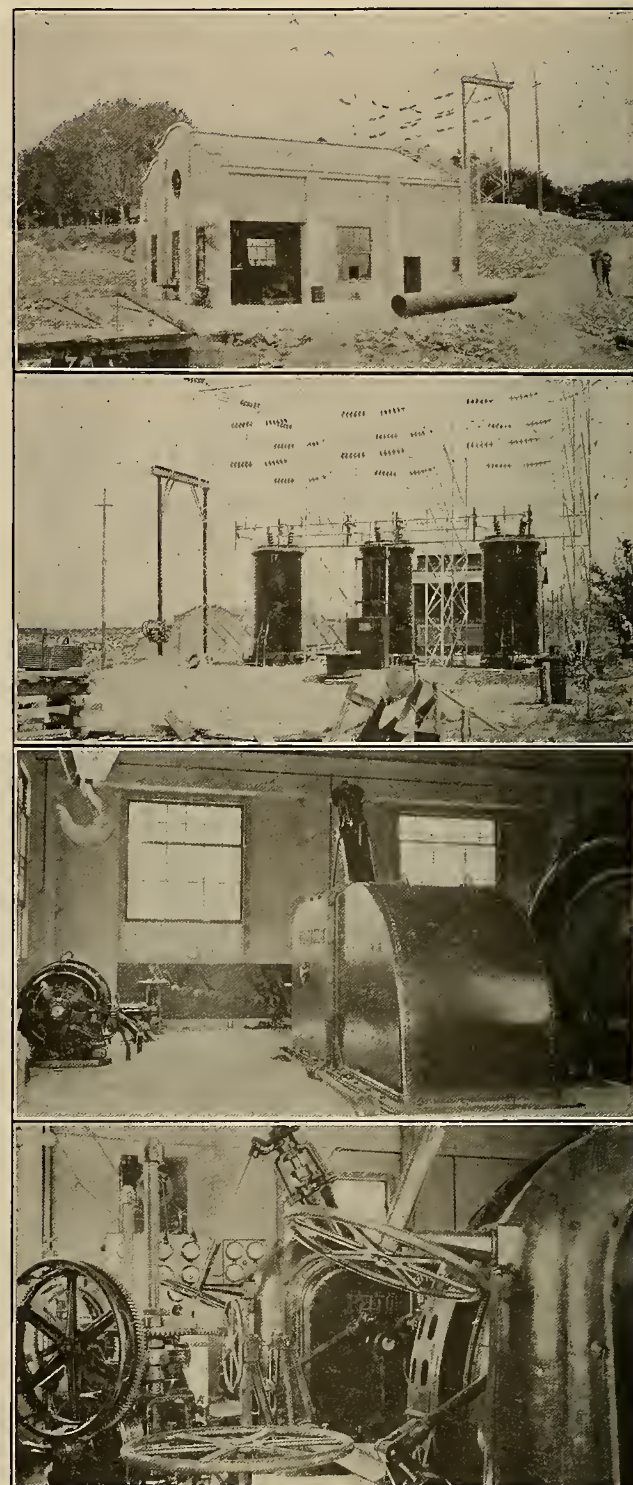
It has been already stated that No. 6 and No. 3 were plants operated by the Southern Sierras Company and were the newest plants, both having been built at the same time. No. 5 is well away from the foothills and the ground surface from No. 5 to No. 6 is a gradual slope, the latter plant being at the edge of the valley floor. The intake to No. 6, while like the other intakes in style and design (except No. 2, which is earth with concrete core) is new and from the engineers' standpoint has a good deal of style. The dam wall is 10 in. thick with an 18 in. coping on top, flush with the upper side of the wall, and the buttresses, which are 12 in. thick, are spaced 15 ft. apart.

Forebay Reservoir and Intake for No. 6 Power Plant.

The dam, which is 300 feet long, is not straight, although the axes of the two end lengths are about parallel and the intake box, which is of concrete, being in line with the pressure pipe is set skew with the wall. In this box, the sloping screen is inside the box while the two entrance sluice gates cover the back wall. The spillway has an ogee section but has also fitted to its crest a removable flashboard 30 in. high. This is held in place by 1 in. sloping iron braces, fastened into the crest of the weir. The total height is 15 ft.

The pipeline is of wood stave construction for a length of 3,000 ft. It is 60 in. diameter. The staves are redwood cut from 2½ in. stock which finishes to 2⅛ in. thick. This pipe was furnished by the Pacific Tank and Pipe Company. The remainder of the pipeline is riveted steel 54 in. diameter and varying in thickness from 3-16 in. to ⅜ in. This section has a length of 4,700 ft., giving the pipeline a total length of 7,700 ft. Throughout its length the pipe is laid in a trench, the depth of which is equal to about the diameter of the pipe, but the latter is nevertheless covered thoroughly with earth and hand placed rock.

The powerhouse building of No. 6 measures 30 x 42 ft. inside and is a replica of Nos. 2 and 3, although smaller than either one. The operating hydraulic head is 258 ft. and like No. 5 there is but one main generating unit. This plant is very simple in design and in operation and particularly suitable to a system of the sort to which it is connected. The main generating unit is placed at the center of the building, its shaft parallel to its greatest length. The generator rated at 2000 k.v.a. was built by the Allis-Chalmers Company. There are two pedestal bearings mounted on the concrete foundation, the armature ring being carried on sliding floor plates. The unit has a star connected armature giving 2200 volts and the speed is 164 r.p.m. This low speed was selected, notwithstanding the requirement for a heavier generator, to permit of



Views of Powerplant No. 6: The Powerhouse. The Transformer Station, a Transformer Water Coil Is at the Left. The Main Generator. One of the Pelton-Doble Waterwheels, and the Exciter. Gate Valves and Switchboard.

a sufficient waterwheel diameter to efficiently handle the large streams necessary in using but two runners. The waterwheels are mounted on either end of the generator shaft and are housed in cast iron cases. Each wheel has two needle nozzles, the one horizontal

delivering its stream at the lowest point of the wheel, while the other points downward, its delivery pipe being carried up from the main feedpipe through a large cast iron gooseneck. The needles in the nozzles are controlled, each by its own hand wheel. A Lombard type Q governor controls the unit by operating deflecting hoods over the nozzle tips. The usual motor operated oil pump supplies the governor with oil under pressure. Cast on the sides of the waterwheel casing is the compound name, Pelton-Doble, which shows that somebody got history inverted when he constructed the old adage, "the best of friends must part." To supply water to the nozzles a Y casting at the end of the pressure pipe connects to two feeders 30 in. diameter and in these are placed reversible waterwheel operated cast steel gate valves. The exciter in one unit is placed at the opposite end of the building from the switchboard. It consists of a four-pole (with interpoles), Allis-Chalmers, 120 volt 50 kw., d.c. generator, operating at 860 r.p.m., one 66 h.p., 2200 volt induction motor of the same make, driven by a two-runner, needle nozzle, Doble-Pelton water wheel with gate valves of the same make. The nozzle needles are operated from a stand in front of the switchboard, connection being made and motion transferred through an endless bicycle chain running over sprocket wheels fixed to the valve spindle, the chain passing over both sprockets and turning them simultaneously. The switchboard is of marble with Westinghouse instruments. There is one generator panel, one exciter panel, narrower than the first a short General Electric type T. A. voltage regulator panel, one swinging panel and placed at right angles a panel for the exciter induction motor. The generator circuit breaker is mechanically operated remote control, General Electric, type K-12.

The transformers and high tension switching apparatus are placed on high ground adjacent to the powerhouse. There are three Westinghouse 750 k.v.a., water cooled, outdoor type raising transformers. These are wound for 2200 volts primary and 87,000 volts from the secondary, there being taps to give lower voltages for connection to the present system using 55,000 volts. These transformers with star connection deliver 140,000 volts. The arrangement of the disconnectors and high tension switches is the same as at power house No. 3.

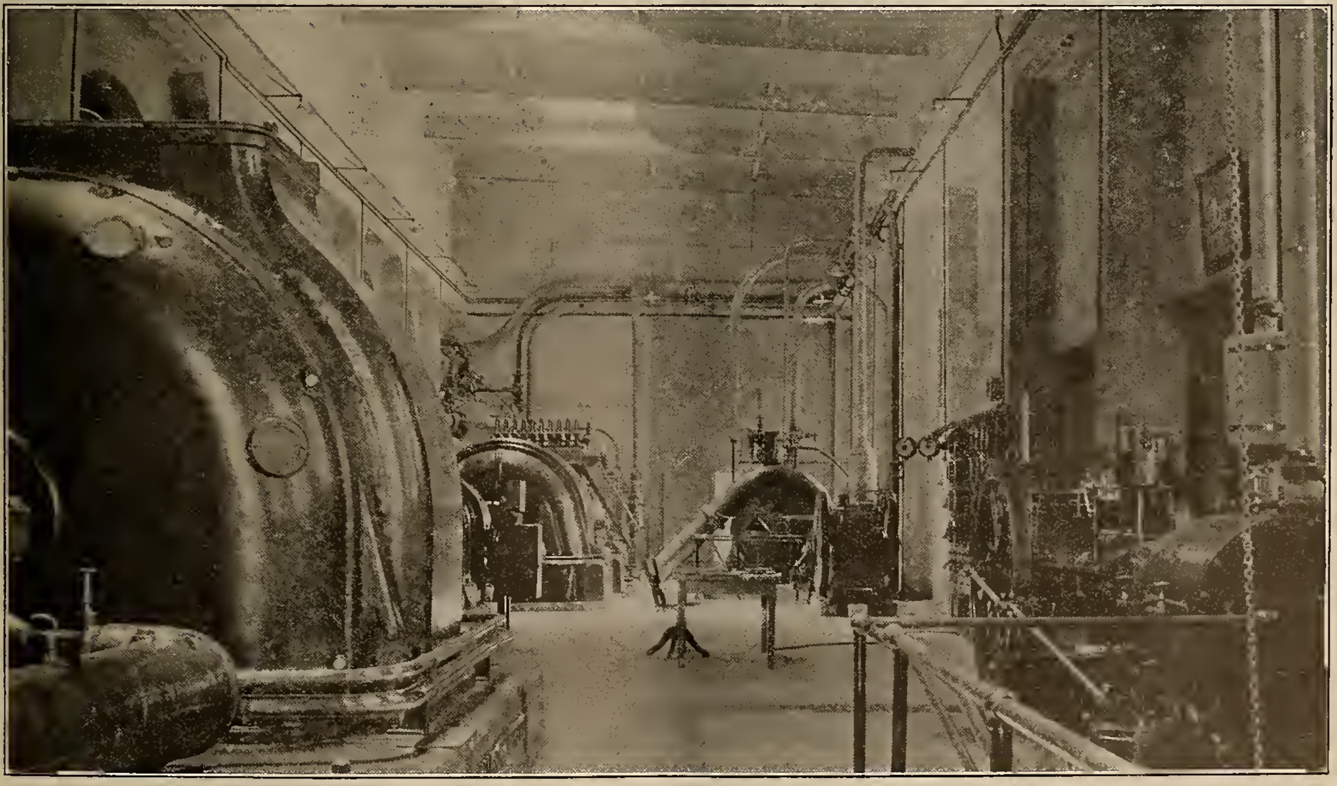
Throughout this system of power houses all switches are hand operated and as before stated no automatic devices are used except governors.

All of the power houses are provided with hand operated traveling cranes of 20 tons capacity, these cranes having been built by the Cyclops Iron Works of San Francisco.

Auxiliary Steam Plant at San Bernardino.

Placed on a tract of ground covering about two acres, adjacent to the track of the Atchison, Topeka & Santa Fe Railway, on the outskirts of the city of San Bernardino, this plant represents a most satisfactory example of modern steam practice, with some features, including simplicity and roominess, for which it deserves especial study.

The building is of reinforced concrete, rectangular in shape, with an extension at about the center of one side. The main part is 132 ft. long and 64 ft. wide inside measurement, while the wing extends from the main part about 40 ft. There are two bays, divided longitudinally by a row of columns, but which are otherwise open to each other. The roof and crane runways are supported on heavy reinforced concrete columns, while the walls of the same structure have a



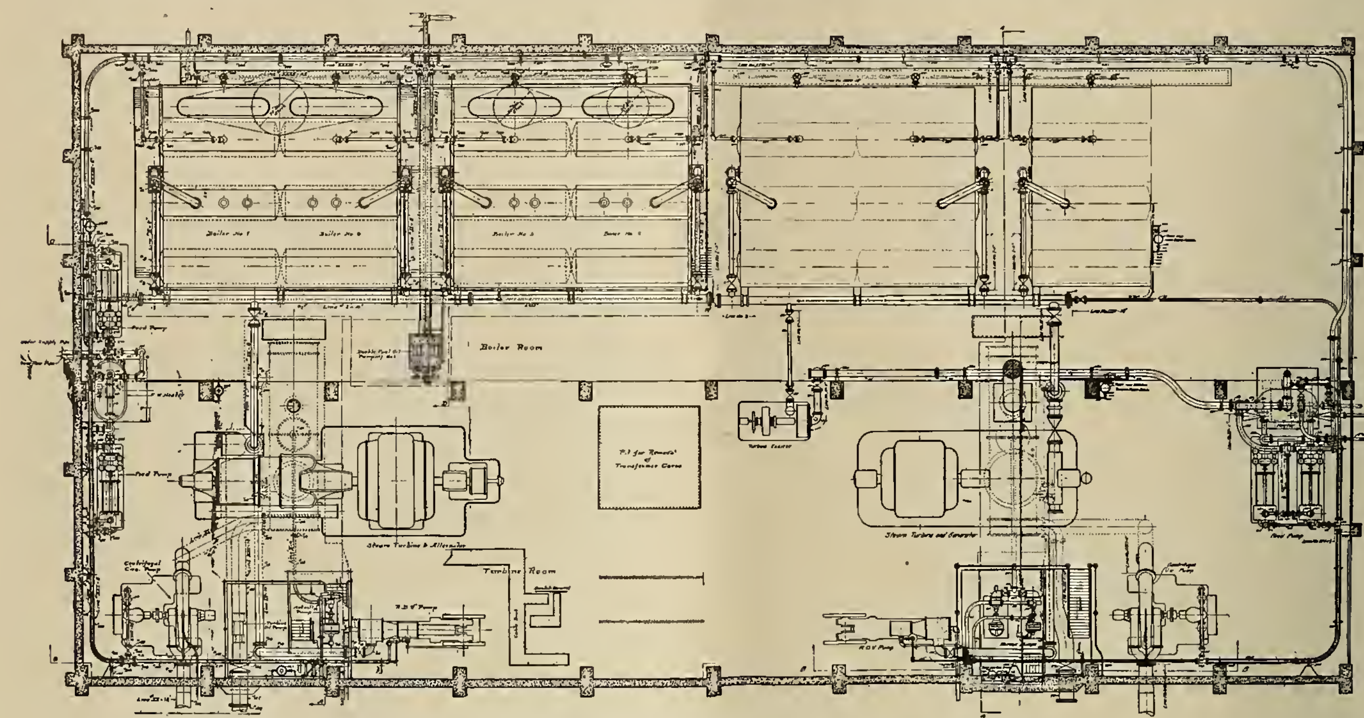
Interior View of San Bernardino Steam Generating Station.

thickness of 10 in. steel I beams support a concrete slab roof which is nearly flat.

All of the machinery, auxiliaries and boilers are placed on the main floor, the boilers in a line in the more southerly bay, their fronts facing the other half of the building and being open to it. The main generating units stand, their shafts in line as close to the center columns as the space and convenience will permit, while the auxilaries are placed more or less close to the more northerly wall, leaving a wide and commodious space or runway throughout the length of the building. The switchboard is also on the main floor level and is placed flush with the north wall at the center of the building and behind this is the building extension in which are placed in three floors, switches, busses, rheostats, and transformer repair shop. This arrangement concentrates in a comparatively small space, all of the essential apparatus of the plant giving the greatest ease of access by those in charge and requiring the least effort and consequently a reduction in the running force to a minimum consistent with safety.

The boilers are arranged in pairs with the exception of the last set which has but one boiler and there are seven boilers in line. These are Stirling, Class O, and are rated at 501 boiler horsepower. Each boiler contains 360, 3½ in. tubes which terminate at the upper extremity in three 42 in. drums, while at the lower end is one 48 in. mud drum. Superheaters are part of the equipment and steam is taken from the side of the pair through the conventional valves, and check valves, there being space between each pair of boilers. The steam connections run in a long curve to the header which is supported against the row of center columns at a height convenient for inspection and repair and also for connection to the turbines. The furnaces are equipped with Hammill oil burners pumps for transfer of oil from the storage tank to the burners. Two steel tanks with a capacity of 2500 bbls. each, receive fuel from tank cars which are run to the tank over a spur from the main line of railway. The boilers, auxiliaries and construction were furnished by the Chas. C. Moore Company of San Francisco.

There are two horizontal main generating units. One of these is a General Electric-Curtis, Class 4, form and there is provided the usual equipment of steam



Plan of Layout, San Bernardino Steam Generating Station.

L, turbine operating on 180 lb. steam pressure. The capacity of the generator is 5000 kw. and operates at a speed of 1800 r.p.m. The voltage of the generator is 6600. The other unit, the first to be installed, was built by the Allis-Chalmers Company. The turbine is of the standard capacity for a 3000 kw. unit, although susceptible of heavy overloading. The generator has a capacity of 5000 kw., is the same voltage as the other unit and operates at the same speed. A four pole 50 kw. exciter is mounted on the generator end of the shaft of this unit. This exciter has two interpoles. The object of installing an oversize generator was for the purpose of having sufficient capacity to charge the transmission line if necessary, the charging requiring capacity in the generator to maintain the heavy current flow which, under this condition, is leading the voltage, forming a wattless component and thus does not represent true energy. At other times the capacity of this unit is sufficient for certain operating conditions and in the event of an emergency call for power, there is sufficient reserve capacity in the turbine to give the generator full energy load for a limited period.

There are two exciter sets, the one driven by a Curtis non-condensing turbine at 3600 r.p.m., has a capacity of 75 kw. The generator has two poles with interpoles and delivers direct current at 125 volts. The other set is a General Electric motor-generator, the motor, induction type I, is rated at 150 h.p., operates

at 900 r.p.m., and receives three-phase current at 440 volts. The generator, of the same make, is a 100 kw. 6-pole and interpole d.c. mochine.

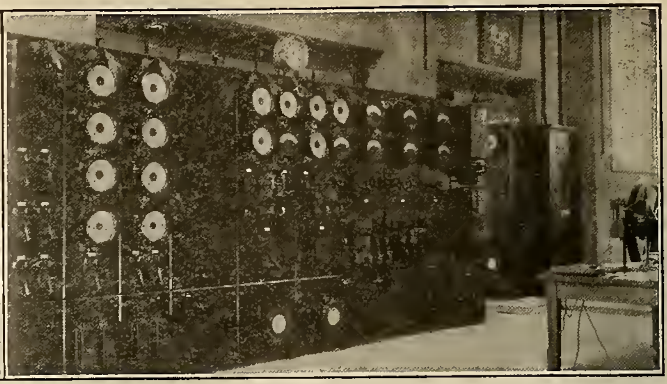
The auxiliaries, complete for each main unit are duplicates and are grouped at either end of the building extending toward the middle. These consist of Wheeler vacuum pumps, cylinders 9 x 22 x 16 in. Wheeler centrifugal circulating pumps direct driven by Reeves vertical, simple, cylinder valve, 10 x 14 in. cylinders, engines. These units stand on the main floor and while prominent objects of notice are well placed for appearance and convenience of operation.

There are two Platt Iron Works, double acting boiler pumps, cylinder 12 x 7 x 12 in. Also Stilwell No. 4 feed-water heaters. In the hotwell which is open, in the main bay, there is one General Electric 7½ h.p., 3-phase motor which drives a 4-in. centrifugal pump. Another unit consists of a similar 4-in. pump driven by a Kerr steam turbine. Water for this plant is pumped from two artesian wells having a depth of about 450 ft. North of the power house and occupying a ground space 85 x 90 ft., is a wooden cooling tower which stands 25 ft. high. Through this structure the hot circulating water from the condensers is allowed to drip, thereby giving off its heat and falling on a concrete floor from which it is drained off into the circulating system. This tower has a cooling capacity of 6 cu. ft. of water per second. The building is furnished with a Whiting Foundry Equipment Company hand-operated traveling crane, having a capacity of 20 tons.

The main switchboard is in 10 panels. It is black slate and was furnished by the Westinghouse Company. The first two panels control high tension switches through remote control connections, and also support the transmission line meters. The third panel has a control for the Valley distribution lines with similar meter equipment. The next panel is blank for future installations. Panels five and six control the output from the main turbo-generators. Each of the next three control an exciter set, and on the last panel are mounted two General Electric type T. A. potential regulators. On another switchboard of the same make there are 10 panels controlling local city circuits, on the back of these are mounted the oil circuit breakers. Also one power panel, 6600 volts and one station panel and detached are one 440 volt fuse panel and a station lighting panel. Throughout this switchboard apparatus is equipped with ammeters and voltmeters, recording and indicating wattmeters, frequency and power factor meters and synchroscope. In the rear of the main switchboard and placed in concrete cells are the 6000 volt turbo-generator switches. These are Westinghouse type E, and have solenoid control. From these the conductors are carried to the next floor where, after passing disconnectors connect to two sets of buses mounted in concrete cells.

On the Right—View of Boiler Battery and One of the Main Turbines.
To the Left—Derrick for Handling Transformers,
Rear Connections of 6600-Volt Busses, Generator Rheostats, Etc.

From each end of both buses, circuits are carried to the third floor to sectionalizing disconnectors and from each set of these to an oil circuit breaker, the one connecting to the transformers of the main transmission and the other to transformers on the Valley distributing lines. The two leads are then connected through a third oil circuit breaker. In a compartment on the second floor are a Cutler-Hammer motor operated rheostat for the Allis-Chalmers main unit, and a General Electric motor operated rheostat for the other main unit. There are also two General Electric 40 k.v.a. potential regulators for the 2300 volt local city circuits. There is also on this floor a repair shop. The second and third floors are reached by a circular iron



San Bernardino Steam Generating Station, Showing Cooling Tower on Right and Transformer Station in Background. View on Right Shows the Main Switchboard.

staircase. On the main floor at one side are placed three 6600-2400 volt, 200 k.v.a. Allis-Chalmers, water and air cooled transformers to give the proper voltage reduction for the local city circuits.

One of the singular features here is a large space in the wing extending to the roof in which is placed a steel derrick of size and capacity to move and raise the large high tension transformers in case of repair. A track entering through a large door affords the means of moving the transformer under the derrick.

From this plant are controlled all of the distributing transmission lines for the territory south of the San Bernardino range. These include three 33,000 volt circuits to Rialto, West Riverside and Corona, and Riverside, Hemet, San Jacinto and Elsinore, also the local 2200 volt circuits covering the cities of San Bernardino and Colton.

A description of the transmission lines, high and medium tension substations, etc., will be continued in Part II of this article.

THE NEW STEAM PLANT OF THE SEATTLE MUNICIPAL PLANT.

BY J. D. ROSS.

The site of the new steam plant of the Seattle Municipal System, to be constructed as soon as the authorized bonds are sold, is at the foot of Nelson place between Eastlake avenue and the east shore of Lake Union, where the present Lake Union Auxiliary hydroelectric plant is located. It consists of a trapezoid 100 by 160 ft., facing Eastlake avenue on one side and Lake Union on the other. This site is almost ideal for such a plant. It will be reached by the belt line of the Northern Pacific Railroad; by the Eastlake line of the street railway system and by water from Lake Union and through the new Lake Washington Canal from Lake Washington and Puget Sound. In addition it has the advantage of being near the geographic center of the city and close to an apartment house district which will provide a good market for exhaust steam for steam heating. Eastlake avenue is 23 ft. above the lake and the site will permit of the turbines being on the level of the street with the condensers beneath and the boilers and pumps on the lower floor next the condensers.

Five thousand boiler horsepower of boilers, in six, eight or ten units, will be installed. They are to be equipped with ovens for burning mill refuse—sawdust, shavings and ground slabs—and also with burners for fuel oil. Steel stacks with induced draft are to be used. The boilers will supply steam at 200 lbs. pressure and 125 deg. superheat to three horizontal, direct-connected turbo-generator sets aggregating 10,000 kw. in capacity. The turbines are to be arranged in such a combination of high and low pressure units that low pressure steam for heating the district east of Lake Union may be secured at the best efficiency of the plant.

Duplicate boiler feed pumps of the multi-stage turbine type, driven by steam turbines, are to be used. The circulating pumps will be centrifugal type, driven by steam turbines, and the exhaust from the auxiliaries will be used to heat the feed water in open type feed water heaters. Piping throughout the plant will have cast steel fittings and welded flanges, high-pressure steam and feed-water pipe to be extra strong. A full set of meters, including recording steam-flow meters and recording steam gage and feed water meter will be installed.

The generators will be 2500 volt a.c., 60-cycle, two-phase machine, feeding directly into the city distribution system. The switchboard and wiring will be of the most modern type, remote control being used throughout in accordance with the practice in the existing plants operated by the lighting department. One exciter, driven by a steam turbine will be used, and a duplicate exciter will be driven with a two-phase motor on one end or a water impulse wheel on the other end of the shaft as desired. Each will be capable of supplying the whole plant alone. Motor and hydraulic duplicate drives will also be used on such auxiliaries as can thus be bettered in economy or in insuring continuous service.

The proposed capacity of the steam plant, with the usual liberal overload specification, will be sufficient to care for the entire load at present. Special attention will be paid to the feature of quick starting, with the idea that the steam plant may quickly take up the load in case of interruption to the hydroelectric generating system. With the completion of the new Cedar River dam, the new steam plant, and with the present Lake Union hydroelectric auxiliary station, the municipal lighting department will be in a position to give unsurpassed service.

THE FAILURE OF CONSERVATION TO CONSERVE.[1]

BY E. H. THOMAS.

Few policies designed for the public good have been abused like that of conservation of our natural resources.

Wise exponents of this policy repeat with tiresome monotony that smug definition of conservation: "the wise use without waste of our natural resources." This definition makes an appeal to the ordinary prudent, thrifty person. The ordinary person, however, has had neither the time nor the opportunity to investigate our conservation policies and to learn whether or not they are fulfilling the promises implied; whether or not as a result of conservation practices we are getting a "wise use" or any "use" of our natural resources.

A bureau in Washington, D. C., called the Bureau of Forestry of the Department of Agriculture, in so far as conservation affects us in any large or vital way, has had supervision and practical administrative charge of the forests, water power and minerals in and on the public domain. This is literally true, despite the fact that water power and public lands are under the jurisdiction of the Department of the Interior. This function of the forest service, supervision of resources on the public domain other than growing and protecting forests, has been usurped by the extension of the forests to cover these resources—water power, coal beds, etc.—regardless of forest conditions. None have disputed its rights. The Bureau of Forestry has been upheld by executive order. It was the pet branch of government under the administration of Colonel Roosevelt, and during those seven years it grew arrogant and tyrannical.

If mineral or water power rights are desired, the forest service has been the agency which obstructed the way. This bureau has always been ready to assume that no locator or claimant within the boundaries of any of the national forests, where most of our undeveloped minerals and water powers exist, came there with honest intent, and as a consequence every step of the proceedings under which water power, mineral or agricultural rights on national forests can be granted, is persistently contested by the forest service.

There could be but one result of such policies, the result that now obtains—stagnation.

The national forests of this country cover an area of more than 190,000,000 acres, an empire larger than Germany. Within these forests are millions of acres of non-forested lands, some 30,000,000 acres of this class, according to the Forest Service reports. As the service regards 4000 feet of timber per acre as timber lands, and as timber of that class in the Western forests is worthless, the actual area of non-forested lands is really about 45,000,000 acres. There should be room for some development here, but what are the conditions?

Hostility to development has marked our conservation policies. This hostility has gone so far as to denounce all who favored development as the foes of conservation. No resource can be touched without a long and expensive contest, in which the claimant or locator is either worn out or impoverished by the delays.

Development in progress within the areas of our national forests is today less than it was when the present forest service was created in 1897. Instead of progress in a part of this country greater than the empire of Germany, there has actually been retrogression.

Instead of use without waste, we have followed a policy of waste without use. Let me illustrate:

The report of Chief Forester Henry L. Graves, contained in the last annual report of the Secretary of Agriculture, estimates the new growth on the national forests at six billion board-feet per year. This is the crop, growing and decaying like wheat. To refuse to harvest it is to lose it. Yet this is just what the forest service has done. At six billion per year the crop for the seven-year period preceding 1912 was forty-two billion feet. What was the harvest? The reports show that the service in that same time, 1905 to 1912, cut 1,901,532,000, or less than 5 per cent of the crop.

Is this use without waste or is it waste without use?

Conservationists have had much to say about coal and water power, but when we invade that field and begin to investigate we find the same proportions of waste and use. The chief coal beds of the Pacific Coast are in Washington, British Columbia and Alaska. The coal of lowest quality is in the State of Washington, and of highest is in Alaska. California has been producing enormous quantities of fuel oil, which have practically displaced coal for all steaming purposes over the entire Coast country. This condition has forced up the price of domestic coal, because of the small proportion of lump and the large proportion of the fine coal heretofore marketed as steam coal, but for which little or no market exists at present.

In 1906 the existing coal land laws were suspended through the influence with the executive of the Forestry Bureau. The pretext for this act was the unfounded charge that some mythical interests were about to steal Alaska, and that abrogation of laws, which to this day have not been repealed, was the only method by which the alleged larceny could be stopped. Out of this has grown the Alaska issue with all its storm and stress, and present stringent coal conditions over the entire Coast.

Now what are the real facts and what have been the results of bureau abrogation of laws enacted by Congress?

The known area of Alaska's coal lands is 21,000,000 acres. Prospectors discovered these coal areas and gave them to the world. In all this vast empire 1100 prospectors staked and filed claims on the modest total of only 32,000 acres, for which they paid to the government $320,000. The government appreciated the work of these men and the hardships they endured so highly that it has refused them the land, kept the money they have paid in, and is now engaged

[1]Read before the National Electric Light Association at its Thirty-Sixth Convention, held at Chicago, Ill., June 2-6, 1913.

in trying to send many of the claimants to the penitentiary.

Up to 1907 Alaska was gaining population. Since that time it has been losing. The reason for this is the refusal of the Federal authorities to permit development. In 1907 the Alaska Syndicate perfected negotiations by which it could enter the coal fields and mine and market the coal. The syndicate owned some copper mines, it was building a railroad and operated a line of steamships. It has $20,000,000 invested, and would have put a total of $50,000,000 into the development of that region if it had not been for the assault made upon it.

A contract to mine coal was made directly with a group of locators who had staked 5 per cent of the Bering River field, and the basis of this agreement was a coal-selling contract by which the Alaska Syndicate was to deliver a large tonnage monthly to the Grand Trunk Pacific Railroad, a Canadian corporation.

This sales contract, the coal needed for coke with which to establish a smelting industry in Alaska, the steam coal used for its ships and local Alaska consumption, would have furnished the tonnage needed to make it possible for the syndicate to build a branch railroad into the coal fields.

All the elements of a great industrial development were at hand. The coal was the key. By refusing to grant titles under any existing laws all plans were upset, however, and Alaska today is a land of buried hopes when it could and should have been a great and prosperous community. Its coal for household fuel and for every industry is imported, and this with 21,000,000 acres of coal fields untouched and undeveloped awaiting some sort of government action, no one knows what.

Not less stupid has been the conservation of our water powers. It can also be said that nowhere in the realm of conservation could a wise use of a natural resource have been productive of so much good.

Water power can be wasted only by a failure to utilize it. Power from steam is generated at the expense of the world's fuel supply. Every pound of coal consumed is gone forever. It can never be replaced. Water power can be used over and over again, as often as the required head can be furnished along the course of a stream; and then over and over again along this entire course as long as the processes of evaporation and precipitation keep the forces moving. This means that just as long as streams flow on this globe water powers will be inexhaustible.

Water power will be here in the natural course of events long after coal beds have ceased to exist. To use this water power now is to prolong the life of our coal resources. The more water power we harness the more coal we have left in the ground for the needs of the future. To use this water power is to make use of a present wasted, although inexhaustible energy, and to use it is to save the nation's coal. This use would be conservation. Its non-use is profligacy pure and simple.

Are we conserving either coal or water power by our present national policy with respect to this use, or should I say non-use?

In an article printed in "Pearson's Magazine" last January, I touched upon the lack of development of water power on the public domain. In reply to this in the May issue of the same magazine, Mr. Gifford Pinchot denied the charge, but anaylsis of his denial shows it to be only an evasion.

Just before the Hon. Walter L. Fisher, Secretary of the Interior and a conservationist, went out of office, he said, in speaking of water power and its development on the public domain: "The regulations now demanded are so prejudicial to power investments that they (the investors) are not going on the public domain. These disadvantages are conceded, but no remedial legislation is in sight."

A short time ago Mr. Daniel W. Adams, an assistant forester, a practical lumberman and a former engineer with long years of service in railroad construction, filed charges of waste and inefficiency against the forest service. He did this only after a vain effort to secure needed reforms within the service. In his bill of particulars Mr. Adams discusses water power as follows: "The water powers of the national forests are at present the most important resource of the country, and as time goes on will, in my judgment, predominate over all others. The present development of this important resource is handicapped by regulations which by their nature forbid its utilization."

Here are two conservationists who have had occasion to study conditions and who know whereof they speak, who were in different departments of the government, and who agree perfectly on the reason for the non-utilization of this resource.

Mr. Pinchot's position is entirely different. He has found monopoly in the domain of power development, and he would rather have power waste its energy forever than that monopoly should rear its hated hydra-head anywhere. In replying to me Mr. Pinchot ignores the simple fact that I was discussing development within and on the national forests which cover more than one-fourth of the total area of the State of Washington. He charges that in this state "two corporations have already secured 70 per cent (nearly three-quarters) of all the water power yet developed." He remarks that "comment is unnecessary."

Let us see if comment is unnecessary.

It is variously estimated that the States of Washington and Oregon have a possible hydroelectrical development all the way from 8,000,000 to 25,000,000 horsepower. The amount developed thus far is about 4 per cent of the total available, using the lesser figure. If the two corporations "control" 70 per cent of 4 per cent of the total "yet developed," these concerns "control" between them 2.8 per cent out of a possible 100 per cent. Comment may be unnecessary, but my comment is that this is surely a fat "monopoly."

However, Mr. Pinchot can be mistaken in his figures as well as in his deductions. In this instance he is mistaken in both.

Mr. Pinchot says: "This same powerful group" (the General Electric Company) "controls 55 per cent of the water power in the State of Washington, in

which two corporations have secured 70 per cent of all the water power yet developed."

Let us now exaimne his figures.

All power sites held in this state by power concerns under private ownership have been developed. The total hydroelectrical energy now available in the States of Oregon and Washington is 311,000 developed horsepower. No two companies control 70 per cent of this however, but three companies, wholly unrelated and at widely separated points, the Portland, Seattle and Spokane regions, non-competitive because of their remoteness from each other, have developed less than 60 per cent of the total; to be exact, 181,173 out of 311,000 horsepower. The Seattle municipal plant has 27,000 horsepower and that of Tacoma 14,000, a total of 41,000. The Inland Empire Railroad has a developed project of 20,000, and the Pacific Power & Light Company 13,267 horsepower. Although the national forests of Washington state are rich in water power, two small projects only developing an aggregate of 12,000 horsepower are on the public domain. One of these has abandoned further development and has purchased private rights because of the opposition of the Reclamation Service to any extension of power development by the impounding of the waters of Wenatchee Lake.

If only 311,000 horsepower have been developed out of a possible 8,000,000, how does Mr. Pinchot arrive at the conclusion, which he states as a fact, that the General Electric "controls 55 per cent of the water power of Washington state?" If there are at least 8,000,000 horsepower, and only 311,000, or less than 4 per cent, are developed, how does he arrive at the conclusion that a monopoly exists?

Analyzing Mr. Pinchot's contention, we have found that the smallest estimate made of available power, developed and undeveloped, is 8,000,000 horsepower. The developed energy is 311,000 horsepower, or less than 4 per cent of the total. This is in the hands of six companies and two municipalities, a condition rather different from that pictured by Mr. Pinchot when he said "55 per cent of the water power in Washington is controlled" by the General Electric Company, and, "two corporations have succeeded in securing 70 per cent of all the water power yet developed."

If, however, some one really has a monopoly of water power on Puget Sound, how has it worked? This is the test after all.

Before any hydroelectrical project has been developed in this region, electric current sold here for as high as 20 cents a kilowatt-hour. Consumers pay a 6-cent maximum today. Seattle's local power, light and traction corporation is manufacturing more current than can be consumed under present demands. Last year this company delivered and used in Seattle alone 365,500,000 horsepower hours of electrical energy. It takes 3.64 pounds of Washington coal to generate one horsepower of energy. It is therefore evident that this company's development—none of it on the public domain—is saving 650,000 tons of coal per annum, and the total development of the two states nearly 3,000,000 tons, which, with the freight added, is worth more than $8,000,000.

There is a chance here for some conservation, but the real conservationists, after all, are the men Mr. Pinchot denounces as monopolists and power grabbers. They are saving the coal for future generations, and reducing the price of electriicty to present consumers; but these so-called monopolists have been forced to make huge investments to acquire private power sites, while those on the public domain remain unused and unoccupied.

The reason, and the only reason, for this is that stated by former Secretary Fisher in putting this situation up to Congress, that "the regulations now demanded are so prejudicial to power investors that they (the investors) are not going on the public domain."

When it is considered that the national forests are greater in aggregate area than all Germany, and that their administration has produced wasted crops, idle resources and a constantly growing deficit, which has mounted to nearly $20,000,000 since 1905, the conclusion that conservation has not conserved is inevitable.

Conservation is desirable. No one wants to see our resources wasted by profligate use; nor should we go to the other extreme, as we have done, of wasting them through non-use. One is as bad as the other. It is time for this country to place the administration of the public domain on a business basis, which can be done by employing practical business men to carry this work on instead of the theorists and politicians who have brought conservation into disrepute, and made it odious to that section of the country which suffers most from the stagnation of idle and unprofitable wildernesses.

ELECTRICAL METHODS OF COMMUNICATION.

The Panama-Pacific International Exposition at San Francisco in 1915 will display in a most comprehensive manner the achievements and activities of mankind during the last decade. Electrical methods of communication will provide many new and interesting features. Among these will be the now perfected system of wireless telegraphy and the latest developments in wireless telephony. The dictograph method, as well as the modern devices used in long established methods of communication by electricity, will also prove a source of much interest. The improvements in fire alarm and police signals will likewise command a great deal of attention by reason of the protection they afford to both life and property. These exhibits will be housed in the Palace of Liberal Arts. Application for space should be sent to Chief of Liberal Arts, P. P. I. E., San Francisco, Cal.

ELECTRIC PLANT PROFITS IN CHINA.

The boom in electric light and power affairs in Hongkong is illustrated in the fact that the Hongkong Electric Company (Ltd.) has declared a 16 per cent dividend on its capital stock of $600,000 local currency ($288,000 gold at present exchange), besides passing 5 per cent to reserve and writing off over 20 per cent of total capitalization in allowance for plant depreciation. The net profit the past year was $277,712 local currency ($133,302 gold).

THE CONSERVATION CONGRESS.

Fire waste in the cities of the United States as allied to Forest and Water Conservation will be given a prominent place in the deliberations of the Fifth National Conservation Congress to be held in Washington in November. Facts and figures emphasizing the tremendous loss caused by unnecessary fires will be laid before the congress by speakers of National note and means considered for the reduction of this annual waste.

General Manager W. E. Mallalieu of the National Board of Underwriters, is giving the matter his close personal attention. He has just returned from Washington where he appeared before the Advisory Board of the Conservation Congress in the interest of the fight against fire waste. In addressing the Advisory Board he pointed out that reduction in the number of preventable fires in the cities of America is closely allied to the general question of conservation. "Reduce the destruction of buildings," said Mr. Mallalieu, "and you are taking an important step toward conserving the natural resources of the country. This is especially true in relation to our forest resources. Every building that is destroyed unnecessarily involves a needless drain on the nation's supply of timber. In the course of twelve months this is a tremendous factor. By the same logic the fighting of needless fires compels unnecessary waste of water, and this too, involves the question of conservation. A large percentage of the fires in our cities can be prevented. This is what we want to help bring about, and the congress can be of immense assistance."

Officials of the congress believe that the Washington session will be the largest and most important in the history of conservation. The meeting this fall will be the first time the conservationists have met in Washington since the conference of governors in the White House five years ago. In the years between, they have been meeting in the West. This year, they propose to invade the national capital and take up the fight for forestry and the regulation of water power grants. These two questions promise to loom big in congress next fall, and it is understood that the conservationists will try to make a big demonstration just before the congress meets by bringing together leaders of public opinion from all parts of the country who will discuss the issue on forestry and water power.

CIVIL SERVICE EXAMINATIONS.

The United States Civil Service Commission announces an open competitive examination for senior electrical engineers, of two grades, on July 21st, 1913. Salaries of the first grade range from $3,000 to $4,800 per annum, and those of the second grade range from $1,800 to $2,700, with expenses when absent from headquarters. Another examination for electrical engineers will be held on July 23, 1913, and from the register of eligibles resulting from this examination, positions at salaries ranging from $1,080 to $1,500 per annum will be filled. These examinations are to be held for the purpose of securing men to work with the Railroad Valuation Committee of the Interstate Commerce Commission. Application blanks may be obtained at any branch office of the Civil Service Commission.

POLES PURCHASED IN 1911.

According to a recent Government publication, the total purchases of poles in the United States in 1911 amounted to 3,418,020 sticks of timber; of these, 2,402,724, or 70.3 per cent, were purchased by the telephone and telegraph companies; 787,649, or 23 per cent, by the electric railroad and electric light and power companies; and 227,647, or 6.7 per cent, by the steam railroads. The total number of poles purchased represents a decrease of 452,674 as compared with 1910, and of 320,720 as compared with 1909; but it exceeds the totals for 1908 and 1907 by 168,866 and 134,752 respectively. The decrease in the purchases of 1911 as compared with 1910 was confined to telephone and telegraph companies and steam railroads, while substantial increases in purchases were reported by the electric railroad and electric light and power companies.

Cedar, which has long been the preferred wood for pole purposes, supplied 61.4 per cent of the total number reported in 1911.

THE STEAM CONSUMPTION OF LOCOMOTIVE ENGINES FROM THE INDICATOR DIAGRAMS.

"The Steam Consumption of Locomotive Engines from the Indicator Diagrams," by J. Paul Clayton, has issued as Bulletin No. 65 of the Engineering Experiment Station of the University of Illinois. This Bulletin develops and illustrates the application of the logarithmic diagram to locomotive engines. It is shown that the steam consumption of locomotive engines can be determined from the indicator diagrams alone to within 4 per cent of the actual consumption as measured in test plants. Copies may be obtained upon application to W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

LARGE RESERVOIR FOR IRRIGATION AND GENERATING ELECTRICITY IN ITALY.

A bill submitted to the Italian-Parliament by the Minister of Public Works, acting in concert with the Ministries of Agriculture, Industry and Commerce, of Finances, and of the Treasury, proposes construction of a large reservoir by means of a dam to be erected on the Tirso River, in Sardinia, primarily for irrigation, but also for generating electric power. The construction contemplated involves the creation of a reservoir of about 40 miles in perimeter, capacity 430,000,000 cubic yards, and $5,000,000 expenditure; it will irrigate some 50,000 acres of arid land, and also afford means for generating about 10,000 horsepower (equivalent in electric power to 7456 kilowatts).

"THE PROPERTIES OF SATURATED AND SUPERHEATED AMMONIA VAPOR."

"The Properties of Saturated and Superheated Ammonia Vapor," by Professor G. A. Goodenough and Mr. W. E. Mosher, has been issued as Bulletin No. 66 of the engineering experiment station of the University of Illinois. This bulletin contains two tables of the properties of saturated ammonia and an extensive table

of the properties of superheated ammonia. The essential results are embodied in a convenient chart by means of which the usual practical problems of refrigeration may be solved graphically with a minimum of labor and with a satisfactory degree of accuracy. Copies of Bulletin No. 66 may be obtained upon application to W. F. M. Goss, director of the engineering experiment statiin, University of Illinois, Urbana, Ill.

THE SALESMAN'S CREED.

I believe in my job, I believe in my firm, I believe in my goods, I believe in myself.

The interests of My House are my interests—its friends are my friends.

I serve My House, but to serve it best, I must serve my customers honestly and well, for they are the friends of My House.

I honor My House for its principles—

The principle of Integrity.
The principle of Fairness.
The principle of Progress.
The principle of Strength.

I believe My House is founded upon the bedrock of Square Dealing with its customers and with its salesmen. With such principles behind me, what can stand between me and success?

I believe that the products of My House are important factors in the general prosperity and that in selling these products I am doing a useful and good work.

I believe that every sale I make benefits the buyer equally with myself.

And so I am proud of my work, of My House, of my product. I shall not allow the misrepresentation of others to abate that pride, nor a lessening of my own energy and loyalty to detract from the results, to which My House and I are entitled.

My House trusts me.

Shall I prove unworthy of that trust?

(Editor's Note:—The above is taken from a poster issued by the American Pulley Company, and is a creed to which every salesman might well subscribe.)

ELECTRICAL TRADE IN ENGLAND.

The imports of electrical goods and apparatus other than machinery and telegraph and telephone wire for 1911 and 1912 amounted to: Electrical goods and apparatus (other than machinery and telegraph and telephone wire)—1911, $6,985,821; 1912, $7,093,633; electrical machinery—1911, $5,113,839; 1912, $5,603,049. The corresponding exports were: Electrical goods and apparatus (other than machinery and telegraph and telephone wire)—1911, British, $13,720,483; foreign, $953,839; 1912, British, $21,266,066; foreign, $1,097,556; electrical machinery—1911, British $8,714,534; foreign, $293,338; 1912, British, $9,602,363; foreign, $333,448.

The position of the electrical trade in the United Kingdom in 1912 was very satisfactory, not so much, perhaps, in the actual turnover for the year as in the favorable indications for the future. In the colliery districts there was an increased use of electrical machinery; there was an extension of the electric railway systems in London and other parts of the United Kingdom; there were serious proposals to apply electricity to the propulsion of ships which, it is stated, will result "in the putting to sea of two vessels, one of 500 horsepower being built in England and one of 5000 horsepower being built in America"; there was a strong demand for electric machinery growing out of the great activity in shipbuilding; electric motor cars came into wider service; and there was an enlarged use of electricity for heating and cooking, as well as for lighting purposes. These conditions show how strong a position the electrical industry holds in the business world.

MARKET FOR ELECTRIC MOTOR CARS IN ENGLAND.

This office has had considerable correspondence with American manufacturers of electrically propelled vehicles who were considering their introduction into the United Kingdom. A number of years ago an effort was made to popularize the electric vehicle here, but troubles with batteries, difficulties of construction, and poor design prevented its sale. Since the remarkable improvements in storage batteries and design made by American manufacturers all these drawbacks have been removed. The price of electricity is sufficiently low to make the use of electric vehicles profitable for commercial purposes, but the difficulty has been and continues to be that the electric supply companies and the municipal electric supply departments have not encouraged the use of electricity as they might have done with profit.

INDIVIDUALISM.

BY JOHN R. MILLER.

(From Edison Current Topics, June, 1913.)

A condition of society that will permit the individual to acquire the full measure of reward for labor, be it done with brain or brawn;

That will restrain the strong from impinging on the weak;

That will nurture a kindly humanity for the helpless and afflicted;

That will not coddle in indolence the degenerate progeny of worthy parents;

That will assure to the thrifty the necessities and a fair share of the pleasures of life, and yet permit of an accumulation to this end—

That they may provide for themselves and for their dear ones against the time of the lengthening shadows, when the day's work shall have been done.

WIRELEESS TELEPHONY ON JAPANESE SHIPS.

The Toyo Kisen Kaisha (Oriental Steamship Company) has installed wireless telephone apparatus aboard the Shinyo Maru in addition to its wireless telegraph instruments. It is proposed to test out the wireless telephone apparatus on the Inland Sea of Japan and to continue its use if tests prove satisfactory. This wireless telephone apparatus is the invention of Japanese engineers associated with the Japanese Department of Communications at Tokyo.

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POWER AND GAS

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NOTICE TO ADVERTISERS.
Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1890.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Transforming the Desert

The barren West cries for water; without it, only a howling wilderness is possible, but with its proper application to western soils, no more productice lands throughout the world can be found. The great power companies of the Coast are not asleep in regard to the future possibilities of power consumption in the small pumping plants now being so generously installed in the great valleys of the West.

The electrically operated pump is a source of revenue to the power company and a joy forever to the farmer. In most of our productive valleys an abundance of water is found within 30 to 60 ft. below the surface of the ground, and a properly installed electrically operated pump possesses many advantages superior to any other known mechanism accomplishing the same end. The water is under the complete control of the land owner and he is not dependent in any sense upon his neighbors, for his supply stands ready to be applied at any instant, day or night. There are no boilers to explode, no gasoline tanks to catch fire, and above all, a perfect operation is possible without complicated parts to keep in constant repair. It is cheaper to install and costs less to operate, and this cost never fluctuates throughout the year. The complete equipment is easily started almost instantaneously, and, in the parlance of the up-to-date farmer, "it is on the job, day and night."

Above everything else, the electrically operated pumping plant makes the farm a more livable place. It lessens the so-called "continual round of pleasure" in performing the daily chores, for it brings power to the barn and with it the possibilities of delicate dishes for the invalid and a Sabbath day's rest for the housewife. A thousand comforts are added to the daily life on the farm. The house, the cooler, and the barns can be lighted at any moment in sudden emergencies. Lower insurance rates on the barn and house make security and economy possible to a higher degree. A cool breeze provided by an electric fan is ever ready for the hot summer day, while a gentle warmth for the chilly spring and autumn days is possible from the electric heater. The long winter evenings strengthen the family ties by making the home more enjoyable with the soft, pleasing yet clear steady light of the electric lamp.

The independence enjoyed by the farmer, when electrically operated pumps are installed can hardly be conceived, without comparing his new surroundings with the previous condition of servitude under which he labored before. An opportunity of power consumption of electrical horsepower by the millions is thus opened to the great power companies and happy homes by millions are thus made possible in every commonwealth of our western empire.

A representative western hydroelectric development described elsewhere in this issue, seems destined to transform what has been a desert into a veritable flower garden. This is only one instance of what western engineers are doing for the development of the country.

The Public and the Public Service Utility

It is a curious and yet unmistakable phase of the life of any great American city, that there is in the public mind a positive and deep-rooted aversion to the corporations which control great public utilities. This aversion is sometimes founded on good reason, but is more often due to an indefinable mistrust and to thoughtless prejudice. Poor service or excessive tariff provides fair cause for protest or complaint, but not for the popular presumption that any and every public utility corporation is a natural enemy to the community. We too often lose sight of the fact that the fundamental interests of a city and a corporation which operates a public utility in that city are necessarily identical or parallel. The prosperity of a public service corporation obviously must depend upon the prosperity of the community in which it operates.

The first principle of a public service corporation is, of course, to serve the public. Unless it succeeds in doing so by giving a fair measure of satisfaction, it cannot realize a profit on its investment. While the majority of public utilities are natural monopolies, no community will long tolerate a monopoly which provides inferior service.

The general hostility to public service corporations is encouraged by sensational newspapers, because their editors realize that savage assaults upon the managers and the methods of these corporations will strike a responsive chord in the majority of their readers' breasts. Of more serious moment are the intrigues, usually fostered by at least a portion of the press, of jealous rivals and the mischief-making of eternally reckless agitators.

Meanwhile the public service corporations go on from day to day providing us with utilities that we have come to regard not only as essential, but as our birthright. But, supposing for even twenty-four hours every public utility to which a civilized community has grown accustomed was suddenly cut off. Can we picture the chaos and paralysis of every-day life that would follow the sudden interruption of light service, the cutting off of our water supply, the complete cessation of the telephone system, and not a street car running? In some of these matters, indeed, we have suffered sufficiently to realize the intolerable inconvenience and the grievous losses that are involved as soon as one of these public utilities is even temporarily out of joint.

The growth of a corporation which tends to make it stronger within offers the most vulnerable point of attack to the agitator. As a corporation grows and its customers increase the effect of a strike is more keenly felt, and that this fact is realized by leaders and agitators is plainly shown by methods which are being pursued. Advantage of the public inconvenience of a strike against a large company is taken and when this corporation is made to bow to the laborer the increased wage is used as a club over smaller organizations. There is a certain limit of wage beyond which the corporation cannot be forced to go and until this point is reached, causing some definite action regarding regulation to be taken, there will probably be no solution of the strike elimination problem.

In the bustle of every-day existence we do not pause to consider the vital part that each great public utility plays in our lives, directly and indirectly, and if we did so our distrust and prejudice against these corporations might be tempered by a consideration of their merits. Certainly we should be less prone to regard these essential factors in modern civilization and business as natural enemies, and we should not be so ready to accept with approval the assaults of every reckless demagogue and to hurl our own brickbats of thoughtless criticism the moment we experience an unavoidable accident or temporary inconvenience.

Conservation

As a conserver the engineer has been far more effective than the legislator. The one utilizes natural resources and the other in trying to hoard them permits them to go to waste; one is a humanitarian whose efforts are compounded, the other a miser whose gold is buried and its power lost. The engineer constructs and upbuilds the dormant power of the waterfall and thereby benefits the human race, the legislator through a mistaken effort to conserve, retards development and progress. This is especially true of our unlimited water powers which are being bottled up, while other valuable products are being wastefully destroyed for purposes to which hydraulic energy is better adapted.

Even granting that several large corporate interests at present control the hydroelectric power of the United States, this is not a cause for alarm when these same corporations are controlled by commissions. A public utility properly regulated can do inestimable good to a community. Although the engineer should not attempt to mix himself to a great extent in politics he should see to it that men are elected who will, for a moment, lose sight of their political views when appointing public service commissioners. Every man, be he big or small. owes a certain allegiance to his state and to the nation. Engineers should at least interest themselves enough in their government to see that no petty political alliance is allowed to interfere with the control of the natural resources of the country.

There will be held this fall in Washington, D. C., a meeting of the Conservation Congress. For four years past these meetings have been held in the West. This year the conservationists propose to invade the national capital and take up the fight for forestry and the regulation of water power grants. Much enthusiasm is being displayed and it is hoped that a definite policy for development will be adopted.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

John Bird, manager Seattle office Westinghouse Lamp Company, spent last week in Portland.

Frederick G. Stafford of Buffalo, New York, is in Seattle and will shortly open an electric and steam specialty store.

John Ryan sales manager of the Western Electric Company's Portland branch spent two days in Seattle recently.

Frank A. Cressey Sr., head of the Modesto Gas, Light and Power Company, was a visitor in San Francisco the past week.

R. Worth, northwest manager American Ever Ready Company, Seattle, spent a week in Vancouver recently on business.

E. A. Finkenbeiner of the Platt Iron Works Company, Dayton, Ohio, is making a three months' business tour of the northwest.

Prof. L. J. Corbett of the department of electrical engineering of the University of Idaho, Moscow, Idaho, is in San Francisco.

W. W. Hanscom is busily engaged in the task of laying out the lighting system of the Civic Center Auditorium, San Francisco.

H. W. Beecher, manager of Charles C. Moore & Company's Seattle branch, has returned from an extended business trip to New York City.

D. E. Harris, salesman of Pacific States Electric Company, San Francisco, has returned from a two weeks' vacation amid the glories of Yosemite Valley.

G. A. Sneider of the Western Electric Company, San Francisco, is on an extended business trip through New York and Atlantic seaboard territory.

A. H. Halloran, vice-president and managing editor of the Journal of Electricity, has returned to San Francisco, after an extended trip throughout the East.

J. H. Buxbaum of the firm of Buxbaum & Cooley, electrical engineers and contractors, Seattle, spent a week at the saengerfest recently held at Walla Walla, Washington.

R. A. Griffin, manager of the pole department Western Electric Company, New York, arrived in San Francisco from Los Angeles where he spent the greater portion of the past week.

Thos. Collins, of the Westinghouse Electric & Manufacturing Company, has returned from an extended trip east. His homeward trip was through New Orleans and the sunny south, where he enjoyed all the sights and scenes of that quaint old land.

L. A. Sprague of the sales department Puget Sound Traction, Light & Power Company, Seattle, will leave July 10 for New London, Connecticut, where he will be connected with the New London branch of the Connecticut Valley Power Company, a Stone & Webster institution.

J. C. Kirkpatrick, president of the National Pole Company, Escantaba, Mich., and **W. M. Carpenter**, vice-president of the American Cross Arm Company, Chicago, who have been in Los Angeles during the past week, were in San Francisco the latter part of the week enroute to Seattle on their homeward trip.

R. G. Littler of the West Coast Engineering Company of -ortland will leave on July 7th for Chattanooga, Tennesse, as tLe delegate of the Oregon Elecerical Contractors Association to the convention of the National Electrical Contractors' Association which meets at Chattanooga on July 15th for four days. Mr. Littler is president of the Oregon association and is also one of the directors of the National body. He will be accompanied by Mrs. Littler and they will visit Washington, D. C.; New York and other points before returning to Portland.

FOURTH ANNUAL CONVENTON OF THE CALIFORNIA STATE ASSOCIATION OF ELECTRICAL CONTRACTORS.

Following is the tentative program of the convention to be held at Santa Barbara, Cal., on Aug. 13-16, 1913:

Wednesday, August 13th.

10:00 A. M.—Business meeting, members only.
2:00 P. M.—Business meeting, members only.
2:00 P. M.—Ladies and visitors sight-seeing trip to Mission Santa Barbara.
8:00 P. M.—Reception and dance.

Thursday, August 14th.

10:00 A. M.—Business meeting, members only.
2:00 P. M.—Business meeting, members only.
2:00 P. M.—Ladies' and visitors' motor trip through the famous Hope ranch.
4:00 P. M.—Ball game in Santa Barbara Ball Park, between the Supply men and the Contractors, for the cup won by the Supply men at the last convention.
8:00 P. M.—Moonlight boat ride.

Friday, August 15th

10:00 A. M.—Open meeting.
2:00 P. M.—Open meeting.
2:00 P. M.—Ladies' motor ride to Montecito and Miramar.
7:00 P. M.—Annual dinner in the Moorish room, after which guests will adjourn to the ball room.

Saturday, August 16th.

9:30 A. M.—Baseball game between the Northern and Southern Contractors for the cup won by the Northern Contractors at the last convention, at the conclusion of the ball game the entire party will be taken to Oak Park where a barbecue will be served. All kinds of games for prizes and dancing for those who wish.
7:30 P. M.—The Statesmen of California will hold a Rejuvention of the Sons of Jove. For the ladies the management of the hotel will give a concert in the lobby by the famous La Monica Band. After the concert and rejuvenation a "Dutch Lunch" will be served in the ball room.

For those who wish to stay over Sunday, arrangements are being made to take a fishing party to Santa Cruz Island, where lunch will be served, returning to the Potter Hotel in time to catch trains returning Monday morning.

MEETING NOTICES.

Oregon Society of Engineers.

The Oregon Society of Engineers held their regular monthly meeting Thursday, 26th of June, at the Commercial Club. Dinner was provided for eighty. Papers and discussions were dispensed with at this meeting and the members took to planning big new activities for the society. That the society has broken into public notice and has become a force to be reckoned with is acknowledged on all sides. The two big accomplishments of the society for the year were the organization of a successful excursion in the interest of the University of Oregon and the putting forward of a successful candidate for commissioner under Portland's new form of government. No further meetings of the society will be held until Thursday, September 11.

Oregon Technical Club.

Mr. Melvin W. Boyle, of the Trussed Concrete Steel Company, presided at the regular Monday luncheon of the Oregon Technical Club. Mr. Marshall N. Dana, of the Oregon Journal, spoke on the "News Getting Organization of a Large Daily Newspaper." Mr. Roscoe Fawcett, sporting editor of "The Oregonian," gave an exceedingly interesting exhibition of many "sleight of hand" tricks. Mr. Dana digressed from his subject and gave the Technical Club some wholesome advice. He said in part: "Technical men as a class do not make their presence felt in the community nearly as much as they should, being trained as they are, because they do not make

enough effort to reach the public in the every day language of the layman. The layman can not understand their language if he wanted to, and the only remedy is for the engineer to adopt the layman's methods of expression, and thereby get the public ear."

NEWS OF CALIFORNIA RAILROAD COMMISSION.

An order has been issued granting authority to the Lassen Electric Company to purchase the Branham plant, at Susanville, for $4500.

The San Diego & Southeastern Railway Company has applied for authority to issue $600,000 of bonds.

The Western States Gas & Electric Company has applied for authority to issue $354,000 of bonds for the purpose of making additions and betterments to its system.

A decision has been rendered granting authority to D. C. Gillen to sell his electrical distribution system in Colfax to the Pacific Gas & Electric Company for $12,000.

The Pacific Gas & Electric Company has applied for authority to extend six promissory notes in the total sum of $150,000.

The Pacific Light & Power Corporation has applied for authority to issue $2,500,000 of stock for financing work upon the Big Creek hydroelectric project.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The Washington public service commission will hold a session the latter part of July or early in August to determine the rates which North Yakima, Walla Walla and some 35 other towns in the Yakima, Columbia and Touchet valleys shall pay for electricity. The general hearing will be held in North Yakima. The Pacific Power & Light Company with headquarters at Portland, is the concern involved. On account of numerous complaints the commission some time ago ordered its engineers to go over the entire plant. After the general hearing a special session for each community will be held to determine how much of the total valuation can be charged against that city and what shall constitute an equitable rate in that community.

NEWS OF ELECTRICAL CONTRACTORS.

The Gamewell Fire Alarm Police Telegraph Company, Cantral building, Seattle, has the contract for putting in a 25-box fire alarm system for Pendleton, Oregon, a similar system for Wenatchee, Washington and small systems for Pasco, Washington, and Hood River, Oregon.

W. R. Hendry & Company, Seattle, have been awarded the contract for installing the electrical equipment, with automatic control system, for the pumping plant to be used in connection with the siphon tunnel constructed by the city of Seattle under the Lake Washington canal.

The contract for the complete wiring in the William A. Rhodes building, at Ninth and St. Helens streets, Tacoma, has been let to George H. Keep & Co., local contractors. The building is to be electrically equipped throughout. Heating will be by means of electric radiators. The apartments will have electric water heaters and stoves.

CHANGE OF ADDRESS.

The American Electric Company, Seattle, electrical contractors and supply dealers, has moved from 118 Third avenue to 714 Third avenue.

On and after July 1st, 1913, the address of the Blake Signal and Manufacturing Company will be 251 Causeway St., Boston, instead of 246 Summer street as heretofore.

The Caldwell Machinery Company, formerly at 524 First avenue South, Seattle, has moved its offices to 512 Colman building. The warehouse and show rooms of the company will be at 804 Post street, same building.

TRADE NOTES.

The City of Port Angeles, Wash., has purchased from the Seattle office of the Fort Wayne Electric Works a 100 kw. alternator for its municipal lighting plant.

George B. Adair & Son Co., Seattle, has been awarded the contract for installing a 50 h.p. Class C DeLaval turbine for the Siloam Sanitarium at Soap Lake, Wash.

The Erie Mill Company, Blaine, Wash., is preparing to install electric motors in its new planing mill. These motors will be furnished by the Allis-Chalmers Company.

The Fobes Supply Company of Seattle has received a contract from the University of Washington for 10,000 ft. of lead-covered cable and 60 pole base transformers.

Birks & Sons, jewelers, Vancouver, B. C., have just placed an order with the Canadian Johns-Manville Company for about 500 ft. of Frink reflector for cases and show windows.

Evans-Dickson Company, Tacoma, have the contract for installing machinery in the substation at Fort Flagler; also contract for additional wiring in the capitol building at Olympia.

The Union Electric Company, Seattle, has installed a 20 kw. type k. s. generator and 3 h.p. slow speed motor at the Troy Laundry. The laundry is electrically operated with individual drive.

The pole depot of the Western Electric Company at Weco, Cal., was destroyed by fire during the past week. It is estimated the loss is between five and six thousand poles. The origin is supposed to be grass fire.

The Tacoma Electrical Machinery Company, 759 South D street, Tacoma, recently installed a 50 h.p variable speed 3-phase motor in the Tribune building. This company has also installed an automatic electric dumb waiter in the Lotus bar grill room.

Kilbcurne & Clark Manufacturing Company, Seattle, has obtained some very satisfactory tests on its micromagnetic detector, an instrument for receiving wireless messages invented by Frederick G. Simpson, chief engineer and general manager of the company.

The Arrow Electric Company, Seattle, is building an electrical float to represent the Rainier Valley district at the Potlatch festivities. The float is being made to represent Mount Rainier in eruption, with electrical decorations around the base advertising the district.

E. A. Finkenheimer of the Platt Iron Works, Dayton, Ohio, recently closed a contract with Oregon City, Ore., in behalf of his company to install an 1800 h.p. water wheel unit to operate under a 40 ft. head at a speed of 240 r.p.m., to be direct connected to a 1200 k.v.a. generator. Charles C. Moore & Co. are the local representatives of the Platt Iron Works,, and the contract was secured through their co-operation.

Bates & Clark, electrical engineers, Seattle, are preparing the plans, furnishing the apparatus, and will supervise the installation of 4-stage 16-inch turbine pump, weighing 50,000 lbs., direct connected to a 1500 h.p. 3-phase synchronous Allis-Chalmers motor, to operate two 5-in. hydraulic giants on a placer mining property near Gold Hill, Ore. This will be one of the largest high-pressure pumps ever operated on the Pacific Coast.

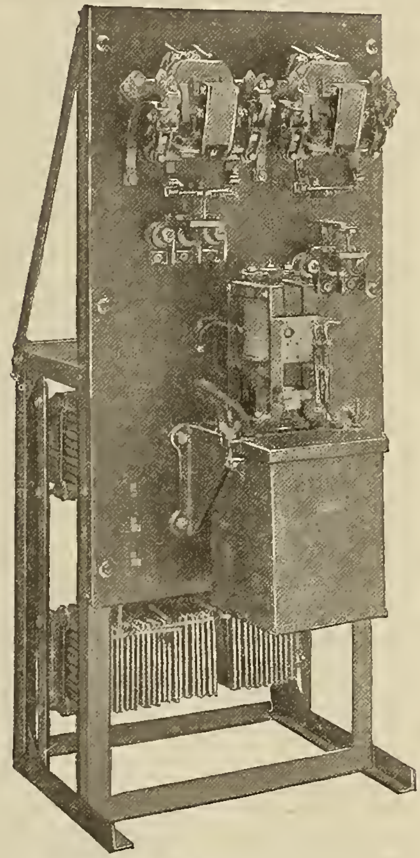
ELECTRICAL CONTRACTORS' LICENSE FIXED AT $20.

The recently enacted San Francisco ordinance requiring electrical contractors to pay a license of $50 a year was amended at a meeting of the Building Committee of the Supervisors this week. The fee was fixed at $20 a year instead of $50, so as to give an equal chance to both small and large contractors. The provision requiring the contractors to file a $100 bond in order to get a permit was declared invalid and hereafter the contractors will save this expense.

INDUSTRIAL

AUTOMATIC CONTROLLERS FOR HIGH VOLTAGE MOTORS.

The Cutler-Hammer Manufacturing Company of Milwaukee has designed a new line of high tension automatic control panels. One type is designed for use with motors driving reciprocating pumps, air compressors or other machines which must be started under full load conditions, and which require a starting torque equal or in excess of the normal full load torque of the motor. The other line, having the same appearance as that shown in the accompanying illustration, is designed for use with motors driving centrifugal pumps, or machines of similar load characteristics, starting under light load conditions. The acceleration is controlled by resistance in each of the three phases of the rotor which is cut out, step by step, by double pole magnetic switches under the control of current relays. By adjustment of the relays the starting current can be set at a predetermined value and the motor accelerated in the shortest time consistent with this current. An oil-immersed solenoid-operated three-pole switch is also



Cutler-Hammer Automatic Controller.

mounted on the panel which controls the high tension motor primary circuit. Where used on water systems, air or vacuum systems, suitable accessories such as float switch, gauge and diaphragm type pressure regulators and vacuum regulators are available.

MOTOR DRIVEN MEAT SLICER.

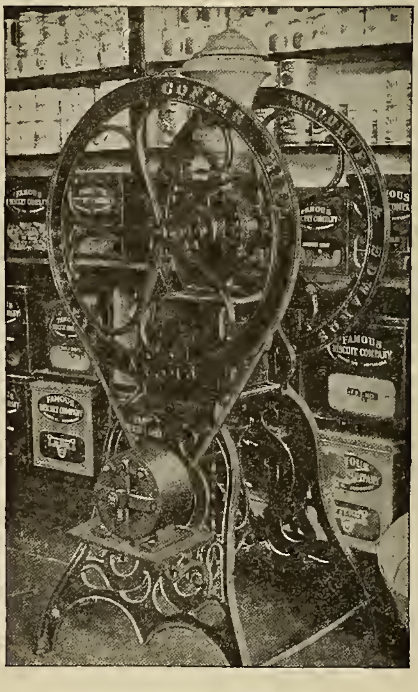
Motor-driven meat slicers are rapidly taking the place of the butcher's knife and hand-operated machines. In rapidity, cleanliness, convenience and economy, the motor-driven machine has no rival. The work of installation is very simple, and the cost of operation is only about one-half cent an hour for continuous operation. With a hand-operated slicer, a great deal of the clerk's time is taken from his most important duty, that of waiting on the trade, whereas, by the use of motor drive, the work is done much quicker and the customers given better service. A small electric motor can very

Motor-Driven Meat Slicer.

easily be belted to any rotary type of slicer, as shown in the accompanying illustration. The motor, if desired, may be mounted on the floor, wall, or ceiling, or on a bracket as here shown. Motors adapted to this class of service are manufactured by the Westinghouse Electric & Manufacturing Company.

MOTOR DRIVEN COFFEE MILL.

An ordinary double-flywheel type of coffee mill operated by hand can very readily be changed to motor drive. The work of installation is simple and inexpensive. The cost of operation is almost negligible since more than 25 lbs. of coffee can be ground for one cent. With an electrically driven mill,



Motor-Driven Coffee Mill.

the clerk fills the receptacle, turns the starting switch, and, while the coffee is being ground, continues waiting on the customers. When grinding a large quantity of coffee at one time, a motor-driven mill not only saves time but also a great deal of hard work, as hand grinding is especially irksome if prolonged. The motor can be mounted on the floor or wall close to the mill, or, as illustrated herewith, on the frame. Motors especially adapted to such service are manufactured by the Westinghouse Electric and Manufacturing Company.

NEWS NOTES

ILLUMINATION.

BAKER CITY, ORE.—The city is considering the installation of a small hydroelectric plant to cost about $25,000.

SUTTER CREEK, CAL.—Sealed bids will be received up to July 21 for an electric lighting system for the city of Sutter Creek.

SAN FRANCISCO, CAL.—The supervisors have passed a resolution setting aside $5000 for illumination purposes during Portola celebration next October.

OAKDALE, CAL.—J. R. Anderson has been granted a franchise for a period of 50 years to lay gas pipes in the streets and thoroughfares of the city of Oakdale, for heat, power and light.

LOVELOCK, NEV.—Steven R. Young of this city, practically sole owner of the Woolsey Light & Power Company, has acquired by purchase the plant and franchise of the Lovelock Light & Power Company.

BELLINGHAM, WASH.—The council has gone on record as being in favor of municipal ownership of a projected light and power plant on the Nooksack River. A committee has been appointed to investigate the project.

OXNARD, CAL.—An election will be held on July 24th for the purpose of submitting to qualified voters the question of whether $30,000 bonds issued for a municipal street lighting system shall be used to purchase and acquire the system of the Ventura County Power Company.

COUER D'ALENE, IDAHO.—The question of installing a municipally owned light plant has been taken up by the councilmen and it has been generally favored. It is proposed either to buy the existing plant or to build a new one. This question will be put to the people later in the year.

VANCOUVER, B. C.—Plans for a gas generating plant in Hastings townsite for the Vancouver Gas Company, to supersede one on False Creek, have been definitely placed before the Civic Board of Works by F. R. Glover, general executive assistant to the British Columbia Electric Railway Company. The first unit is to cost $750,000.

TRANSMISSION.

SPRINGVILLE, CAL.—All rights of way for a new power line which is to be built by the Mt. Whitney Company from the Frazier Valley substation to this city, have been secured and work on the line started with a large force of men this week.

CENTRALIA, WASH.—A crew of men is now at work between Castle Rock and Lexington on the last link of a power line which will connect all of the towns served by the Washington-Oregon Corporation as well as all of the power plants of that concern.

SEATTLE, WASH.—The Olympia Power Company, Port Angeles, Wash., has awarded the contract for the reconstruction of its power dam on the Elwha River to James E. Heyworth of Chicago for $500,000. The dam will be 200 feet high, 600 feet long, and will have solid concrete foundation.

WASHINGTON, D. C.—Secretary of the Interior Lane has recommended and the President has ordered the restoration to entry of 2500 acres on the Owyhee River held unsuited for the conservation of water power, also modification of an order withdrawing 1291 acres known as power site No. 77 on the Snake River in Oregon and Idaho.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has made application for a franchise to construct a single line of poles, with all necessary appurtenances for telegraph and telephone purposes, and to convey electric energy for lighting, power and heating purposes along specified roads, and other public places in King county.

BREMERTON, WASH.—The city of Bremerton is to have a municipally owned electric light plant. It has accepted the proposal of the Bremerton-Charlston Light & Fuel Company to sell for $90,000. The purchase calls for $25,000 cash for which bonds have already been sold to John E. Price & Company and the acceptance of the remainder of the purchase price in utility bonds.

LOS ANGELES, CAL.—The Pacific Light & Power Company has begun construction of its transmission line from the Big Creek hydroelectric development to Los Angeles. The Big Creek development will be of 150,000 h.p. and the transmission line will be 248 miles long, said to be the longest high tension transmission line yet constructed. The line will carry current at 120,000 volts. At Los Angeles the current will be distributed to the city systems and also to the Pacific Electric Railway Company and other utility corporations.

SAN FRANCISCO, CAL.—The State Conservation Commission has begun the hearing of a controversy involving two power and irrigaton projects in Lake and Yolo counties, the conversion of Clear Lake into a storage reservoir, and the carrying of water to more than 100,000 acres of land. The Yolo Water & Power Company is contesting before the commission the right of the Power & Irrigation Company of Clear Lake to carry out certain power and irrigation projects, as defined in the latter company's application to the commission.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company has filed a petition in intervention with the commisson in the Oro Electric Corporation's application to enter Stockton and other portions of San Joaquin county. The Sierra & San Francisco Power Company contends that in the recent order authorizing the Oro Electric Corporation to enter certain portions of San Joaquin county it was allowed to encroach upon the section in which the Sierra & San Francisco Power Company is operating. The Sierra & San Francisco Power Company now asks that this feature of the case be re-opened.

TRANSPORTATION.

SALT LAKE, UTAH.—The interurban electric roads, which include the Orem and Bamberger lines, have determined upon erecting a union station on West Second South street, to cost $40,000.

SACRAMENTO, CAL.—The first electric train between Sacramento and Oakland on the Oakland, Antioch and Eastern, left Sacramento Wednesday morning. This marks an important epoch in local transportation circles.

OAKLAND, CAL.—Walter Arnstein of the Oakland, Anticch & Eastern Railway, has announced that work on the company's new ferry steamer is practically finished and that the boat, which will accommodate eight cars, will leave the yards of the Union Gas Engine Works shortly for a trial trip. A regular schedule between the Key Route pier and the Solano region will be established about July 6, and trains will be running through to Sacramento by August 15. The suburban line is operating over the Key tracks and

mole under arrangement by which a minimum of 50c per car is guaranteed on a basis of full fare for each passenger carried from the junction of the two roads to the Key system ferry slip. The minimum, according to testimony given before the railroad commission, has been $3 per car since the cars began to operate in April last.

SAN FRANCISCO, CAL.—All electric railway lines in the State and the smaller steam roads will be required to file the names of their stockholders in connection with their annual receipts for the fiscal year, which are due to the railroad commissioners after July 1. Electric and power and water companies hertofore have been asked for this information, but transportation companies have been exempt.

FRESNO, CAL.—Construction of the railroad from Muscatel to the townsite of Biola will start about July 15, according to an announcement made from the offices of the Fresno Traction Company. Right of way matters are in such shape now that everything can be turned over to the Fresno Traction Company upon the return of F. W. Webster, general manager. The road was originally promoted by J. B. Rogers and associates.

OAKLAND, CAL.—The Oakland, Antioch & Eastern Railway Company, through Jesse H. Steinhart as counsel, argued before Commissioner Loveland for permission to issue $4,000,000 of its bonds, $1,000,000 of which amount it desires to issue immediately, for construction and other purposes. The total authorized bond issue of the road is $5,000,000, and its capital stock amounts to $10,000,000. Vice-President Samuel L. Naphthaly testified that the road is now operating successfully from Oakland to Bay Point, and that the remainder of the line through to Sacramento is practically completed. The approximate total mileage is 99 miles of main track. The receipts from the sale of bonds to date amount to $2,117,362, of which $500,000 of the bonds have been sold under a contract containing an option clause. The original cost of the road is placed at $3,707,530, which comprises the amount actually expended in constructing it and an estimate, based on such actual expenditure, of the cost of its completion. In arriving at the reproduction value of the road no allowance was made for the extra expense entailed in securing rights of way. The reproduction value is placed at $4,390,523, or $70,170 per mile, as against $59,250 per mile, actual original cost. The commission raised objections to the proposed sinking fund of the company. Commissioner Gordon stated that it was possible changes might be advised before the bond issue was authorized.

TELEPHONE AND TELEGRAPH.

PETALUMA, CAL.—At the annual meeting of the Petaluma Rural Telephone Company the company announced plans to build new lines in various districts.

IMPERIAL, CAL.—Work has been commenced on a toll line between Imperial and Brawley and Imperial and El Centro for the Imperial Valley Telephone Company. Long distance lines will receive first attention.

EL PASO, TEXAS.—Wireless stations will be established immediately by the United States army along the Arizona-Sonora border in order to have direct communication with out of the way places. The wireless stations will be in communication with headquarters at Fort Bliss. The main station will be placed at Sasabs, Arizona.

SAN FRANCISCO, CAL.—At the hearing before the railroad commission in the matter of a readjustment of long distance telephone rates J. P. Shaw, the commission's rate expert, recommended the adoption of a two-minute initial period and the elimination of the 5-cent "terminal" charge. The plan proposed by the Pacific Telephone & Telegraph Company involves the reduction of the present three-minute initial period to one minute with a charge of 50 per cent of the first-period rate for each minute of conversation over the minimum. It also proposed to retain the present 5 cent terminal charge. Shaw declared that his investigations show that the present average duration of long distance conversations is 1.65 minutes and that, under the schedule of rates proposed by the company, $200,000 per annum would be added to the company's net revenues, while his plan would mean a reduction of $400,000 per annum in the tolls paid by long distance telephone users. The company has until July 29 to study and reply to the commission's plan.

WATERWORKS.

TACOMA, WASH.—The Fern Hill residents have petitioned for water service from Green River.

PORTLAND, ORE.—Stoddard & Richardson of Portland are completing plans for the municipal light and water plant to be built at Baker, Ore.

SANTA CRUZ, CAL.—The proposition to bond the city for $220,000 to redeem the water plant, met with almost unanimous approval at a recent election.

LIVINGSTON, ORE.—The city will shortly add two pumps to its water system. The pumps will deliver 75 gallons per minute each, against a head of 550 ft., and will cost $25,000. Since the city has reached the bond limit this improvement will be paid for by the property owners benefiting thereby.

PHOENIX, ARIZ.—The Williams Water & Electric Company without further delay will issue and sell bonds in the sum of $150,000 for the improvement and extension of its system. The bonds will be of $1000 denomination each. This company furnishes water and power to the town of Williams.

OROVILLE, CAL.—An appropriation of 50,000 inches upon the waters of the Middle Fork of the Feather River has been filed by J. H. McKibben, a real estate dealer of San Francisco. The water is to be brought to Oroville by flumes and ditches to a point south of the city.

SAN FRANCISCO, CAL.—The supervisors have passed the ordinance fixing water rates for the coming fiscal year, the charges being the same as those of the present ordinance except that a reduction of 25 per cent in the present charges for water furnished shipping is provided.

DALY CITY, CAL.—Following the success of the Daly City water bonds at the recent election, work will be started immediately. Roberts & Denicke have been appointed engineers of the work. It is proposed to sink five wells about a mile from Lake Merced, where after investigation it was found that there was an abundance of water to furnish a supply for many years and carry the water by pipes to Daly City.

GLENDALE, ARIZ.—An election will be held on July 5th for the purpose of submitting the question of insuring a bonded indebtedness in the sum of $35,000, the proceeds to be used for enlarging and improving the waterworks to be owned and controlled under the jurisdiction of the town. Said bonds are to be of the denomination of $500 each, bearing interest of 6 per cent per annum, payable semi-annually.

WOODLAND, CAL.—R. H. Beamer, manager of the Yolo Water & Power Company has taken a crew of engineers to Davis to make preliminary surveys for an extension of canals. Farmers east of Davis have asked that the Winters-Davis canal be extended east from the State farm. This may be done as soon as the rim around Clear Lake has been acquired, so that the water level can be raised and an ample supply of water insured.

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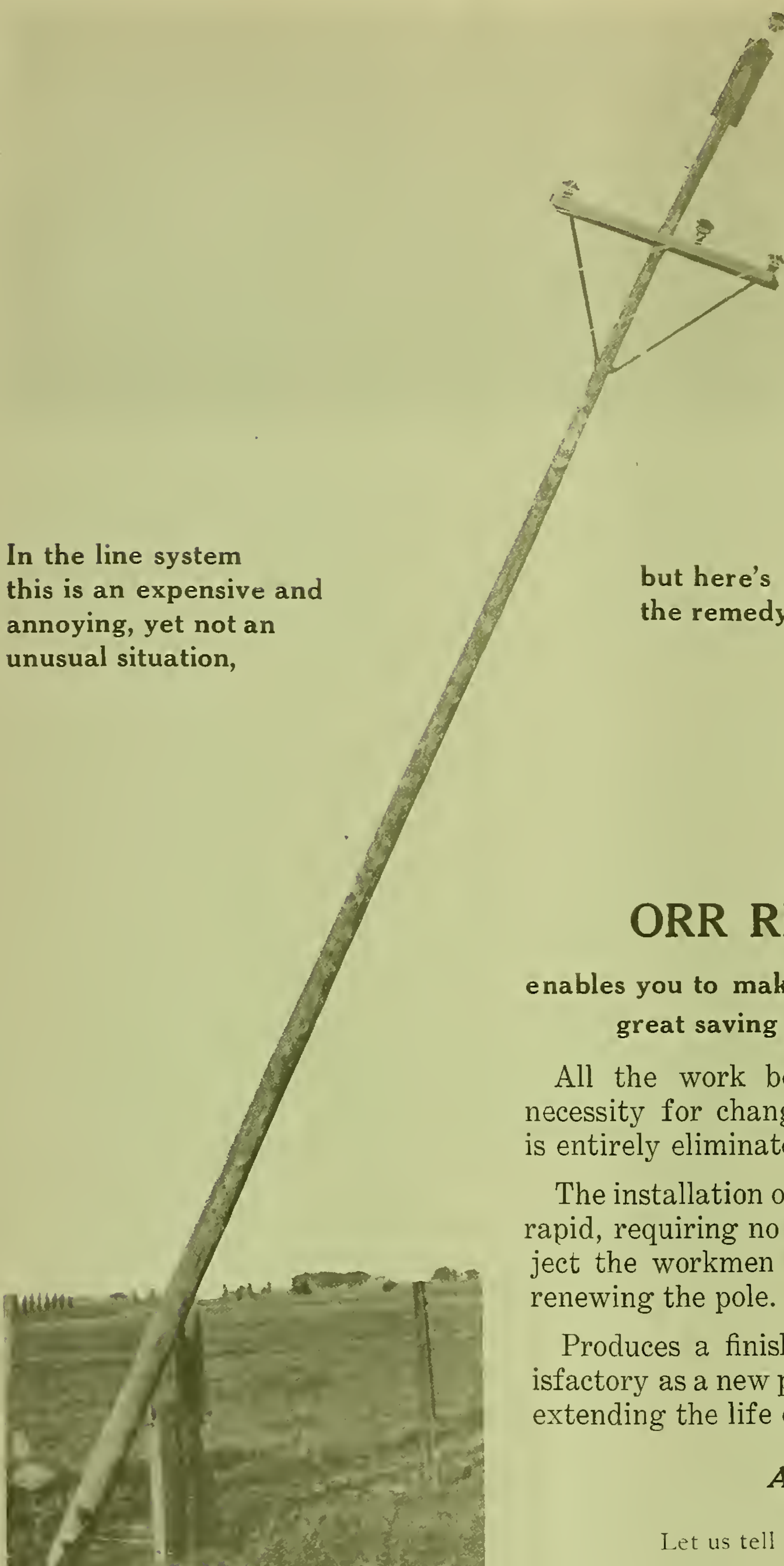

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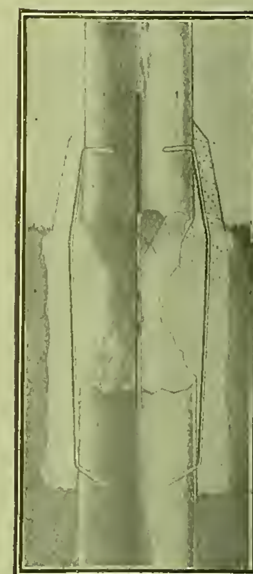

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JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXXI SAN FRANCISCO, JULY 12, 1913 NUMBER 2

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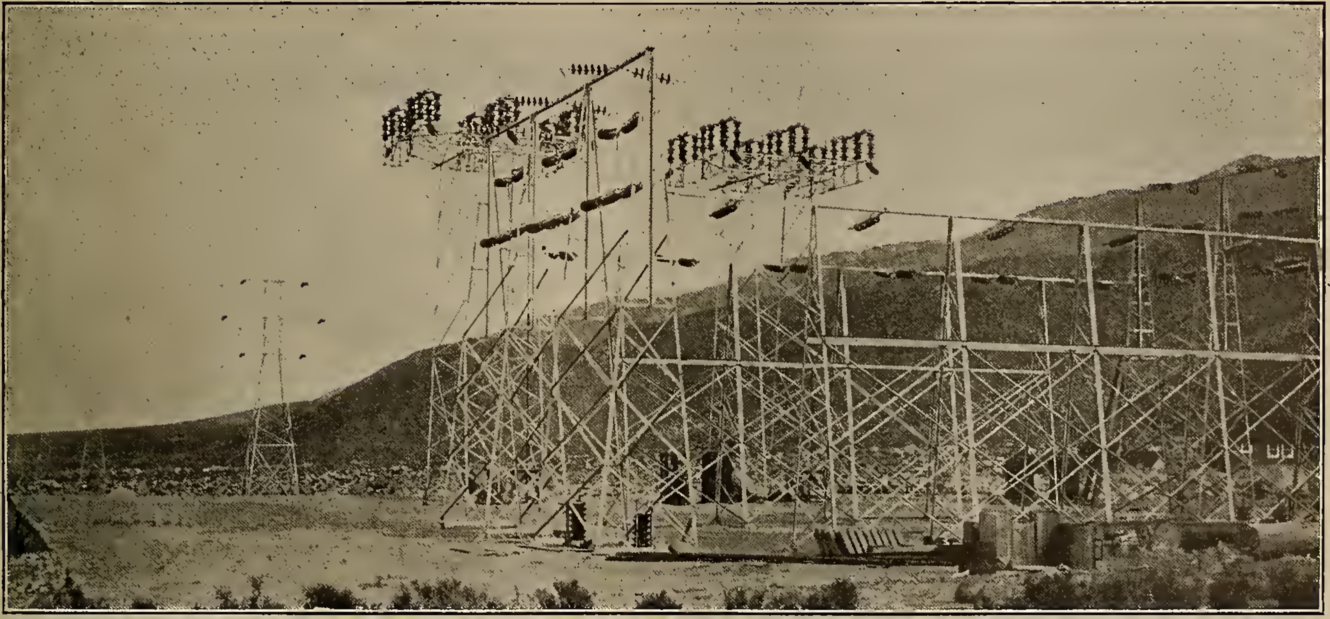
SYSTEM OF SOUTHERN SIERRAS POWER COMPANY

PART II — TRANSMISSION AND DISTRIBUTION SYSTEM

BY RUDOLPH W. VAN NORDEN.[1]



Control Station Near Mouth of Bishop Creek Canyon, and Commencement of Transmission to San Bernardino.

There are a number of features in this division of the newer system which undoubtedly represent modern design and construction in its most advanced form and as such are well worth a close study by engineers and operators. At least seven features, all of them radical steps in the forward progress of the art of transmission and distribution, but taken only after a thorough study of the conditions necessary to make such a transmission commercially possible are noticeable. And an individual study of details in which every feature seems to have been carefully balanced to determine, not the best common practice to follow, but a proper practice to obtain the expected future results, is in evidence. These features which make this system of particular interest are: an advance in the design of steel transmission towers suitable for the highest transmission voltages together with a number of special designs for a particular service; the extreme voltage of transmission; a "wishbone" type of steel pole for single extra high voltage circuits; an uncommonly long uninterrupted transmission; the consistent use, on both high and low voltage circuits of substations without housing of any sort, and finally, the use on practically all circuits whose voltage is above 6600, of air-break horn type circuit breakers.

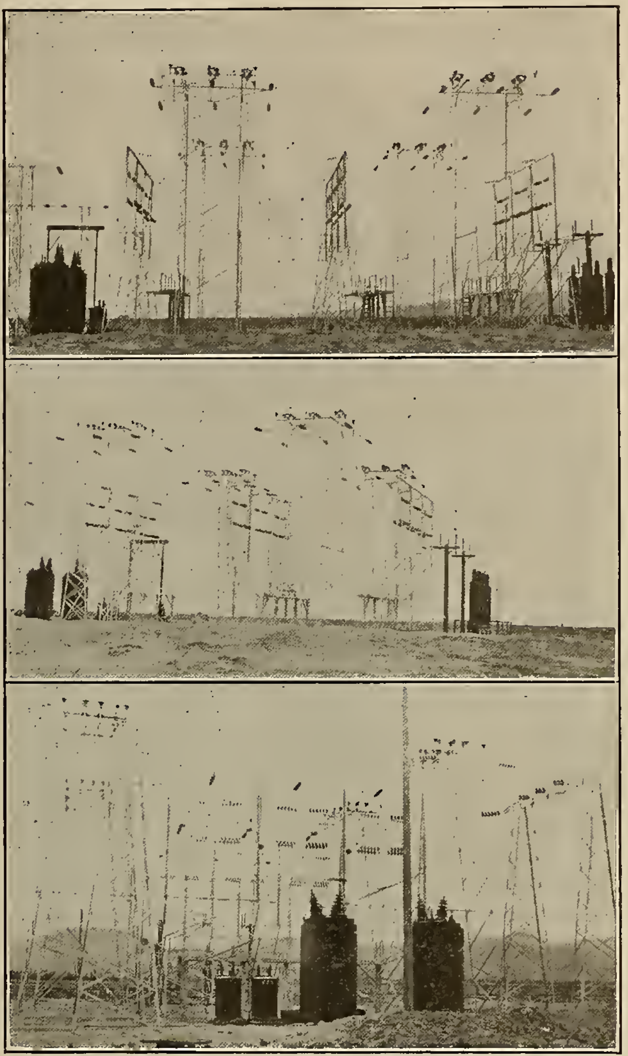
The transmission system may be divided into four distinct parts; single circuits carried on wishbone steel poles, connecting the various power houses with the high tension control station; the high tension transmission line of two circuits carried on steel tower structures; the secondary 33,000 volt transmission lines carried on either lattice steel or wooden poles; and the telephone line on wooden poles paralleling the main transmission.

General Description of Southern Sierras System.

The control station is placed on high ground, about one-half mile below the outlet of Bishop Creek canyon and only a short distance from power house No. 5, and transmission lines from all directions may approach without obstruction. This station, as its name implies, controls the circuits which feed the transmission lines by a series of circuit-breakers and disconnectors and it is the point of commencement of the

[1]Fellow A. I. E. E., Member A. S. C. E.

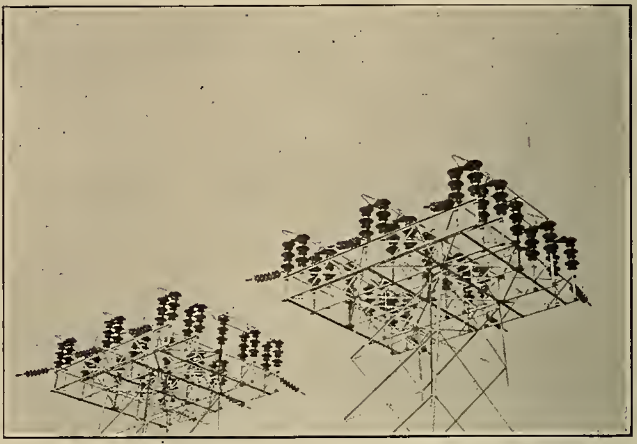
main transmission to San Bernardino. At present two circuits come into this station, the one from the west commencing at power plant No. 3 and following Bishop Creek in a general way. The other circuit enters from the east and is brought from power house No. 6. The transmission line now takes a southerly course following, as a rule, the west side of the Owens valley, passing near Big Pine, Independence and Lone



Three Views of the Substation at Lone Pine.

Pine, there being at the latter place the first transformer station. The line passes to the west of Owens lake and the Hawiee reservoir of the Los Angeles aqueduct, paralleling the aqueduct and the Southern Pacific Railroad through Rose Springs Valley, passing Little Lake, Brown and Inyokern at which point the second transformer station is installed. The general southerly direction is maintained the line passing over a range of hills, thence across Salt Springs Valley to Randsburg, a mining town of importance where the third transformer substation is placed. Crossing another range the line is carried over the Mojave desert in the middle of which the fourth substation is at Victorville. From the desert the line now ascends to a pass in the San Bernardino mountains, following Devils canyon down the south slope and finally terminating at the San Bernardino auxiliary steam station, the total length being 238.16 miles from the control station.

The distribution covering the San Bernardino Valley and the country south of Riverside is all at 33,000 volts, and these circuits of which there are three, are controlled and regulated from this point. One of these circuits covers the northern part of the valley to the westward, the principal point of supply being Rialto. The other circuits are carried together on a line of steel poles, going south, cross the valley into



The 140,000-Volt, Bowie Air-Break, Circuit-Breakers at the Control Station.

Riverside county and incidentally pass through highly cultivated areas and districts characterized by large industrial concerns. Just before entering Riverside, one of the circuits branches to the West, this is known as the West Riverside line. This line passes much highly cultivated land and much which is subservient to a similar cultivation and large population. The line passes through west Riverside, and following the Santa Ana River finally ends at a substation for the supply of the city of Corona. There is a branch from this line to Wineville. The third line supplies the city of Riverside, a contract having been entered into with the municipality to supply all of the current for distribution in the Arlington District of the municipal system. It then passes to the southward a distance of 18 miles through Alessandro and Valverde to Perris which is the center of a very rich agricultural community, entirely dependent however on underground water, raised by pumping, for irrigation. Near Valverde a branch goes southeast a distance of 27 miles to San Jacinto and finally reaches Hemet, 3 miles further, both of these places, like Perris being centers of rich agricultural areas. From Perris the line takes a southwesterly direction, for 16 miles, finally ending at Elsinore, a sizable town prettily situated by a picturesque lake of the same name. These lines are the backbone of a network which is constantly extending. Other main lines are projected, and before this comparatively new enterprise has gotten little better than a good start, there should be possible the reclamation and cultivation of a large part of the many thousands of acres of arid and semi-arid land in this territory through the agency of electric motors driven by power generated from the falling waters of Bishop creek, in some cases nearly three hundred miles away.

Substations.

One of the characteristic features of this system, already mentioned, is the type of substation, or more

correctly termed, transformer station, which type is unique and entirely unlike the practice followed by other power transmission systems. The tendency to the use of so-called outdoor substations has made itself manifest in various parts of the United States within the past year or so but in most cases has been limited to the use of "outdoor" type transformers, the switching apparatus being more or less elaborately housed. The engineers of the Southern Sierras Power Company have carried the open air idea to its logical extreme, and, with the exception of secondary transformer stations, where a local distribution is controlled through a switchboard in which case a house only of sufficient size is used, no housing or protection of any sort from wind or weather has been provided. Poletop air-break switches of the Bowie type have been adopted as standard for all high and intermediate voltage circuits.

The transformer stations are divided into two groups, the style of each group having been consistently standardized. The first group consists of six stations on the high tension, 140,000 volt transmission, while in the second there are eight stations which receive their correct current supply from the intermediate 33,000 volt circuits.

Of the high tension transformer stations the following table will give the location, capacity and distance between stations:

Station.	Capacity.	Distance apart.	Distance from control station.
Control	36,000 kw.	0.	0.
Lone Pine	1,500 kw.	58.	58.
Inyo-Kern	1,500 kw.	67.	125.
Randsburg	1,500 kw.	21.	146.
Victorville	1,500 kw.	61.	207.
San Bernardino,..	12,000 kw.	31.	238.

To this list might be added the raising transformer stations at power houses Nos. 3 and 6. Each of these stations being connected with the control station by a single circuit transmission.

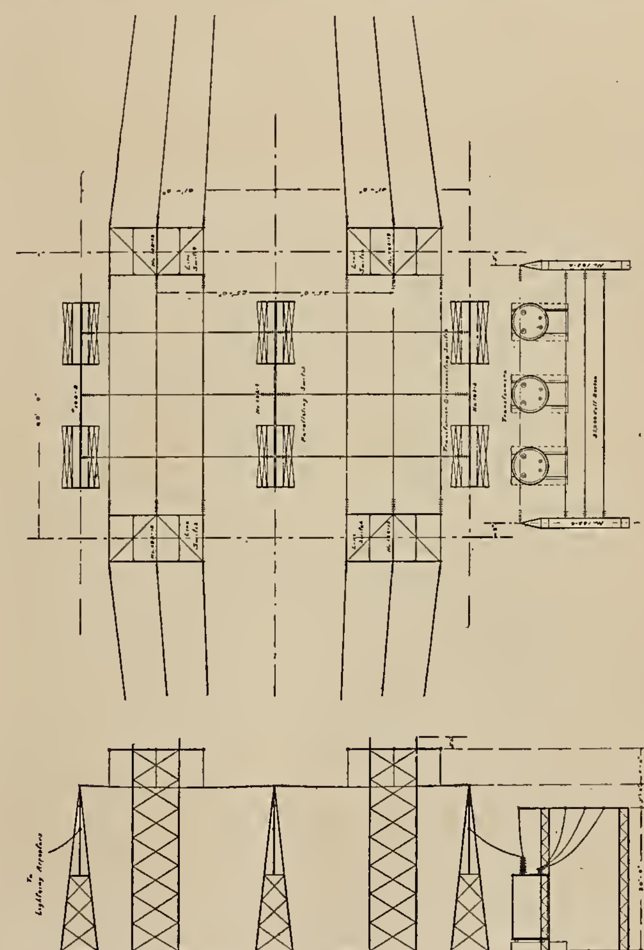
Powerhouse No. 3.	6,750 kw.	4.	4.
Powerhouse No. 6.	2,250 kw.	1.5	1.5

From this it will be seen that the greatest length of transmission, from power house No. 3 to San Bernardino is 242 miles.

Control Station.

The control station is somewhat different from the line stations and is provided for lines feeding in as well as out. The floor of the station is nothing more than a space leveled and rolled on which is erected the tower structures. The plot allotted is sufficient size to accommodate, beside the switching structures, the operator's house, his cottage, a storehouse, etc. The main structure of galvanized steel angles, similar in general dimensions to those used in standard towers, consists of two sets of "A" frame structures spaced about 60 ft. apart, each somewhat outside of the lines from the switch towers. The ends of these structures are connected by two other "A" structures, the whole forming a hollow square. On the first named "A" structures are mounted vertical disconnecting switches and to these, coming from opposite directions are the high tension circuits from power houses 3 and 6. The disconnectors are connected together by a 3-wire bus line stretched across the hollow square. Across the top of the hollow square, above the bus just described, and at right angles thereto, are two bus circuits which continue, each to a main line switch. The upper and lower buses are connected. Below the disconnectors are wooden platforms 10 ft. above the ground on which the operator stands when handling the disconnectors.

Each set of high tension switches consists of two breaks in series, and is mounted on a steel tower structure especially designed for rigidity and the dead-end strain of the transmission line. These switches have a knife break 3 ft. long, the blade of which is pivoted at one end, lifting the free end as it opens. At both ends of the blade are arcing horns made from galvanized iron pipe, the size being 1 in. at the bottom and tapering toward the top. These horns are curved back and away from each other for the purpose of preventing the arc, which is formed in opening, from jumping across the circuit. The free end of the blade, immediately after opening the circuit passes the base of the horn, transferring the arc to the horn. As the blade continues its upward movement, the blade transfers the other end of the arc to the other horn and the arc then travels upward between the horns and finally breaks, the entire action taking practically no more time than the opening of the blade.



Plan and Cross-Section of Substation on 140,000-Volt Transmission.

While the operation of air-break switches on extra high tension circuits has been the cause of more or less skepticism from builders and operators of oil submerged switches, the engineers of this system report so far the utmost satisfaction and surety in operation and, within the means of observation, any un-

usual line disturbances likely to be the cause of damage to apparatus or to service has not manifested itself.

These switches are operated from the switchboard in the operator's house by compressed air, through pipe connection, although a powerful operating mechanism is mounted at the base of the tower. A small induction motor compressor with a steel storage tank of sufficient capacity to operate the switches a number of times in case current should fail, supplies the compressed air. No automatic control is used. Synchronizing between the hydroelectric plants and the steam auxiliary can be done here on the high tension lines and through the means of these switches.

There are to be placed at this station, three 4000 kw. raising or lowering transformers. These will be wound for star connection to the 140,000 volt circuit on one side and for delta connection for 55,000 volts on the other side. They are for the purpose of tieing together the Southern Sierras and the Nevada-California systems, the latter system being operated at the lower voltage.

A set of General Electric, type I, electrolytic lightning arresters is placed at one side and connected through disconnectors to both bus lines.

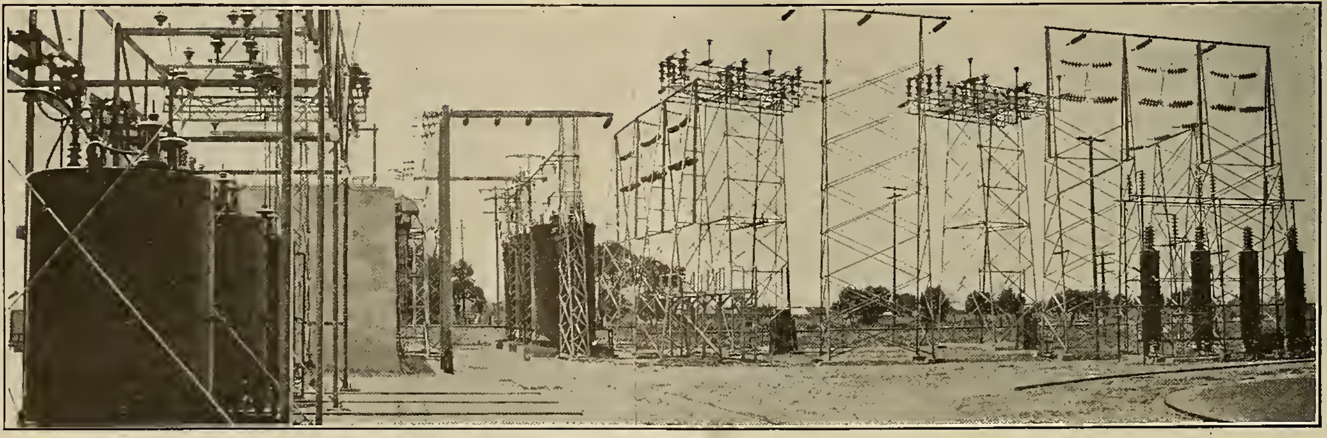
The operator in charge at the control station is virtually load despatcher for the system, the transmission telephone and telegraph being in his charge.

The transformer stations with the exception of the receiving station at San Bernardino, are alike and a description for one will suffice for all.

The station at Lone Pine is about ½ mile east of the town, in the open country which is arid in this locality. There are four sets of high tension double break Bowie switches, mounted as at the control station on steel towers 45 ft. high. These are placed side by side in pairs, the pairs being 60 ft. apart longitudinally and separated between the circuits about 50 ft. Between the pairs of switches are strung the two bus circuits and under these with their axes parallel with the busses are three sets of "A" frame structures. These structures carry each, a set of vertical disconnecting switches of the standard type especially designed for this system. Those on the center structure connect the busses together, those on the structure to the east, connect a circuit to feed a bank of lowering transformers, while those on the more westerly structure have connection to the electrolytic lightning arresters which are placed on concrete bases. Around the arresters is erected a strong wire netting to prevent interference from stray animals or birds. The grounding horn gaps for discharging the arresters are mounted on a pipe structure and their operation is from a wooden platform about 8 ft. high and 30 ft. long. There are three 500 kw. Allis-Chalmers oil-insulated and air cooled transformers provided with water cooling coils to care for overloads. The primary winding is 87,000 volts with a tap for 55,000 volts, the highest voltage to be star connected for use on the 140,000 volt circuits. These transformers are of very heavy construction, the porcelain high tension terminals being, each, about the size of two sugar barrels placed end to end, and being, of course, weatherproof. The cases are cast iron and are mounted on low transfer cars which in turn stand on a track imbedded in a concrete pier 18 in. high. Along the front of the transformers is a transfer track of 8 ft. gauge, and a car on this track may be run to any transformer and the transformer may be moved from the pier to the car and thence to the pit in case of damage or repair. At the end of the track is a concrete lined pit 8 ft. square and 16 ft. deep and over this is a steel gallows frame made of two 6 in. "H" beams and a pair of 15 in. "I" beams across the top. A wire rope double block tackle is operated by a windlass mounted at the side of the frame. By this means a damaged transformer may be lowered into the pit and the core removed and placed on the car or on the ground. There are also a pair of 50 kw. air-oil cooled Westinghouse transformers 33,000 to 2200 volts. These supply a three-phase local distribution to Lone Pine. From this station a 33,000 volt line is carried a distance of 14 miles to Keeler on the east shore of Owens lake. Power from this line is used in operating various chemical recovery works adjacent to the lake. A local superintendent has charge of this station and the district which it covers. The station itself requires but occasional attendance.

From the Inyokern station, there are two 33,000 volt circuits radiating in opposite directions and supply power over a large area, formerly desert, for pumping water.

The Randsburg station is at the end of the main street of that place. From it there are several 33,000 volt circuits. These supply Johannesburg and a num-



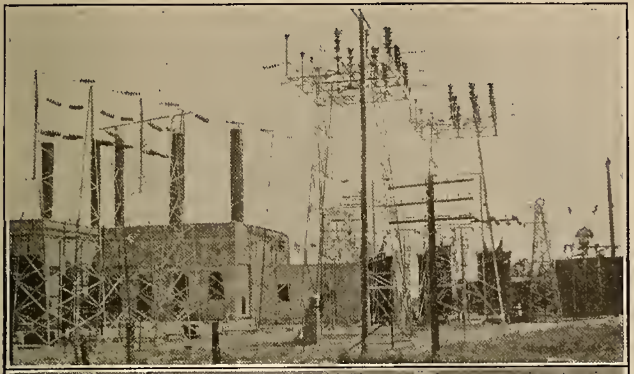
Transformer Station at the San Bernardino Steam Plant. Reactance Coils Are in Concrete Building.

ber of mines and pumping plants in the district. There is also a local lighting circuit. The company has here an office and show room for the sale of electrical fixtures and supplies and with the aid of an efficient sales force has made the settlement quite hospitable and up to date.

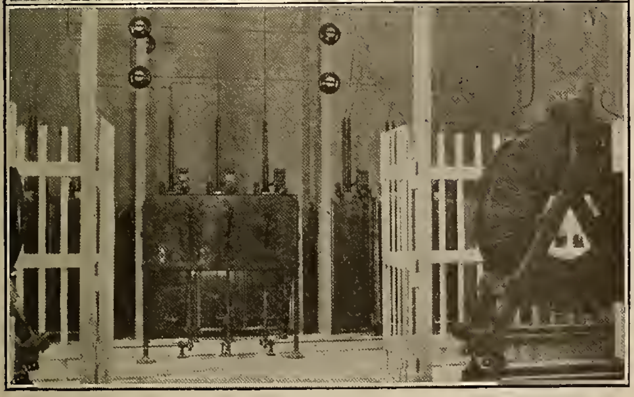
The substation at Victorville has not yet been completed but will eventually do its share in turning the Mojave desert into gardens and alfalfa.

The San Bernardino Terminal Station.

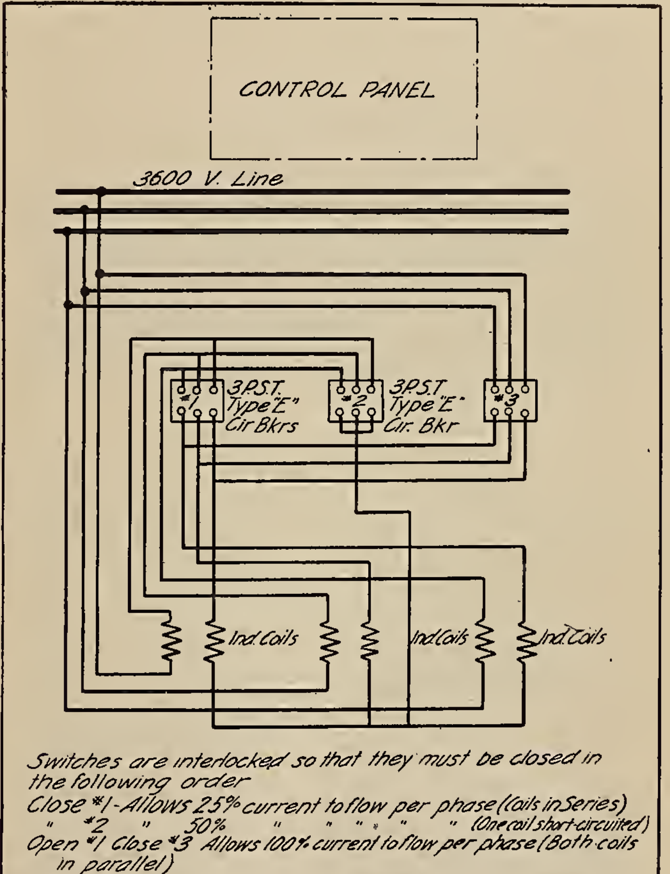
The transmission line terminates at two Bowie, double break switch sets, mounted on towers and similar to those at the control station. The general plan of this station is also similar in its switching arrangements but with a number of added features. The main switches are motor operated and controlled from the switchboard in the power plant. There are three sets of "A" frame structures two of which are on either side of a hollow square. The third is opposite to one of the main switch sets and is connected to it by a bus line and in this structure are the disconnecting switches from which the circuit is carried to a set of General Electric, type I, electrolytic lightning arresters. The bus from the other main switch is supported by a two-pole structural steel frame set in line with the "A" frame just mentioned. Between the end "A" frame structures is strung a cross bus from which are connections to both upper busses and these "A" frames carry disconnecting switches for connections to Allis-Chalmers lowering transformers. But one set of these transformers is in place. There are three transformers in this set of 4000 k.v.a. capacity each. They are wound for 87,000 volts primary to be star connected to the 140,000 volt circuits. The secondaries are wound for 36,000 and 6600 volts, the latter tap permitting the turbo-generators to feed direct to these transformers. These transformers are, due to their high voltage windings and their large capacity, very heavy and bulky and are provided with three sets of copper water cooling coils each. The cases are sheet steel and are mounted on low trucks which rest on concrete piers 5 x 10 ft. A subgrade transfer track passes in front of the transformers and extends to the door opening in the rear of the power house, where a transformer may be taken for repair. A 33,000 volt bus line above the transformers and over the transfer track is carried on two end "A" frame structures which straddle the track. From this bus are feeders which connect to the three valley circuits and to the inductance coils. Two of the valley lines are equipped with Kelman 33,000 volt outdoor type oil circuit breakers mounted on steel towers. The third valley line has a Bowie air-break switch and a similar switch is interposed in a circuit which feeds a secondary set of transformers. This set comprises three Allis-Chalmers water cooled transformers of 2000 k.v.a each, mounted on wheels so as to be movable to the transfer track already described. These are wound for 36,000 to 6600 volts and are intended to connect the steam plant power circuits with the valley lines and incidentally with the transmission through the larger transformers. An angle steel framework over these transformers carries on one side the 36,000 disconnecting switches and on the other those for the 6600 volt circuit.



San Bernardino Steam Plant. Bowie 140,000-Volt Circuit-Breakers in Foreground. 4000 k.v.a. Transformers and Fuel Oil Tank in Background. Reactance House in Center.



Interior of Reactance House, Showing One of the Six Induction Coils on the Right and the Oil-Switch Control in the Background.

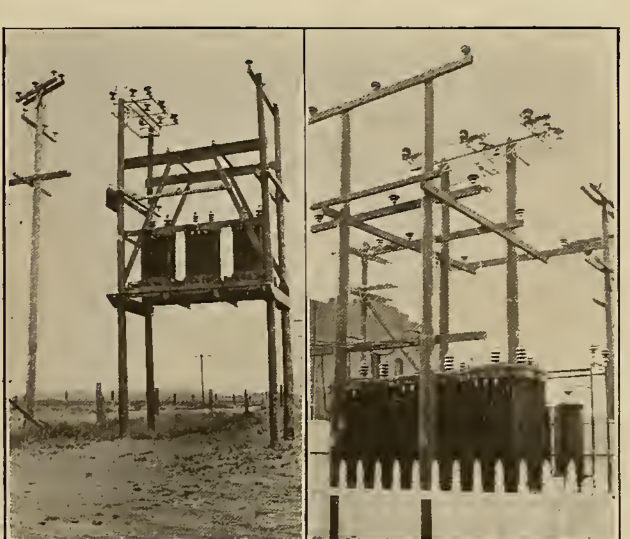


Switch and Wiring Connections to Inductance Coils.

The reactance coils, sometimes called inductance coils are placed in a one-story reinforced concrete building 42 x 22 ft. There are two sets of these coils consisting of three coils to each set and each set is placed parallel with one side of the building. The purpose of these coils is purely one of line regulation. In using high voltages on long transmission lines, the capacity of the circuits acting as condensers would serve, if the line were open at the receiving end, under certain conditions, to give a higher voltage than at the initial end and in any case a higher voltage than the operating voltage which the machines at the receiving end may be designed for. Under this condition, for instance, it might not be possible to boost the fields of the generators in the steam plant to give a high enough voltage to allow synchronizing within safe limits and without putting a dangerous strain on the generators, transformers, etc. By placing reactance in the form of an open core inductance coil across each phase of the circuit, the capacity effect of the transmission line becomes neutralized and the voltage is brought to a point within the limits of ordinary operation. In operating these reactance coils, they are arranged so that the two sets may be placed in series with each other, or by a change in connections, may be placed singly, cutting one set out, or may be placed in parallel, depending on the amount of reactance necessary for the condition at hand. These various changes are made automatically by three sets of three-pole 36,000 volt oil switches. The coils themselves consist of twelve flat coils of one turn per layer and having 60 turns of ribbon wire, all very heavily insulated. The coils are mounted in hard wood frames heavily varnished.

Distribution Line Substations.

The substations on the 33,000 volt distribution lines are much alike. Where a local distribution for lighting is had, there is provided a switchboard which is enclosed. All secondary lines are delta connected to

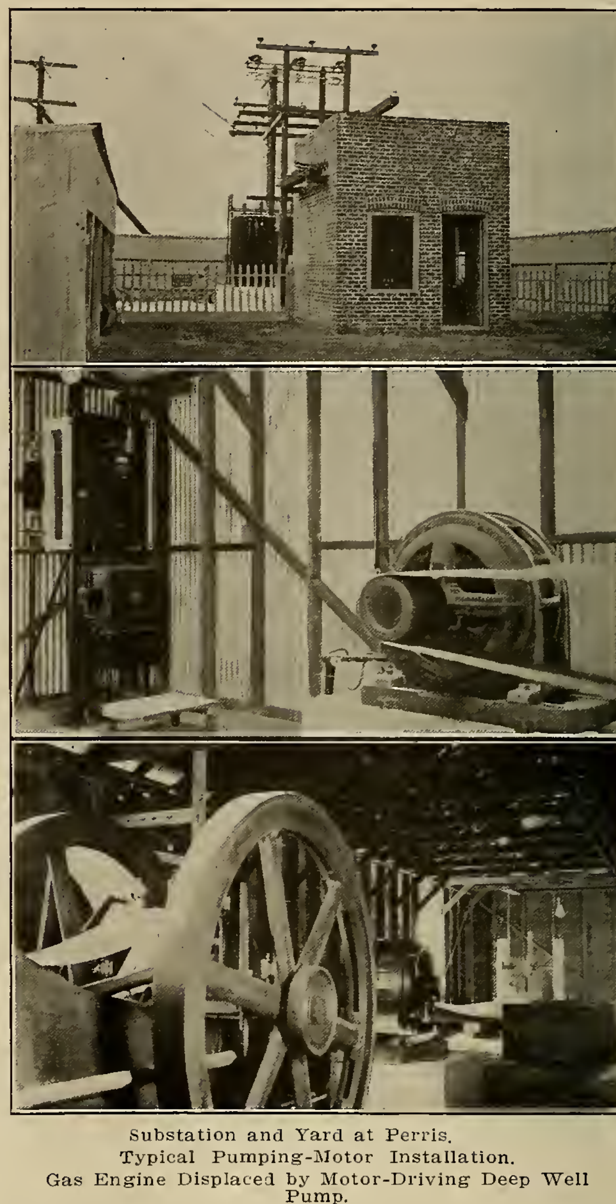


Typical Transformer Installation on 36.000-Volt Distribution in Irrigation District, Left View. Transformers and Arresters at Perris, Right.

the transformers and have a potential of 2200 volts. This potential is supplied to all motors of 15 h.p. and over. Where smaller motors are installed, local transformers are supplied to give the proper voltage reduction.

A list of the substations, with the distances between and their transformer capacity follows:

Substation.	Capacity.	Distance.	Total Length.
San Bernardino S. Plant.....	200 k.v.a.	0. miles	0. miles
Rialto Line:			
Lytle Creek	300 k.v.a.	8. miles	8. miles
Bloomington	300 k.v.a.	inc.	
West Riverside Line:			
West Riverside	1500 k.v.a.	12. miles	20. miles
Corona	600 k.v.a.	17. miles	37. miles
Wineville (branch)	300 k.v.a.	4. miles	41. miles
Perris Line:			
Perris (from S. B. S. P.)..	1600 k.v.a.	27. miles	68. miles
San Jacinto (branch)	450 k.v.a.	17. miles	85. miles
Hemet	450 k.v.a.	3. miles	88. miles
Elsinore	400 k.v.a.	17. mlies	105. miles
Nine Isolated Sets	25-300 k.v.a.		



Substation and Yard at Perris.
Typical Pumping-Motor Installation.
Gas Engine Displaced by Motor-Driving Deep Well Pump.

The stringing of a second circuit on lines built for two circuits will bring the total length of 33,000 volt circuit to 140 miles. The total transformer capacity installed is 6400 k.v.a. and the total number of stations is 19.

The station at Perris, which is typical of most of the others is enclosed by a high wooden fence. In the center of the enclosure are three 300 k.v.a. Ft. Wayne, air-oil cooled outdoor type transformers wound 33,000

to 2200 volts. These are mounted on concrete bases 5 x 15 ft. x 2 ft. high. An equipment of 4 Westinghouse electrolytic lightning arresters is mounted on a concrete base of the same size as that provided for the transformers. Connection to the transmission line is made through one set of Bowie, type K, air-break switches. A 4-panel black slate Westinghouse switchboard with voltmeters, ammeters, polyphase integrating, and type U graphic recording voltmeter is housed in a brick building, 14 x 12 ft. inside, and 12 ft. high. This building has a concrete roof and floor, two windows and a door, and from it are carried three 2200 volt circuits. In the district about Perris the pumping load amounts to about 2000 h. p. Adjoining the transformer station is the company office and store and a material yard and storehouse.

Isolated transformer stations supplying current for a group of pumping plants are constructed upon wooden poles, the transformers being mounted on elevated platforms and the connection to the transmission being made through Bowie switches, mounted on the top of the structure.

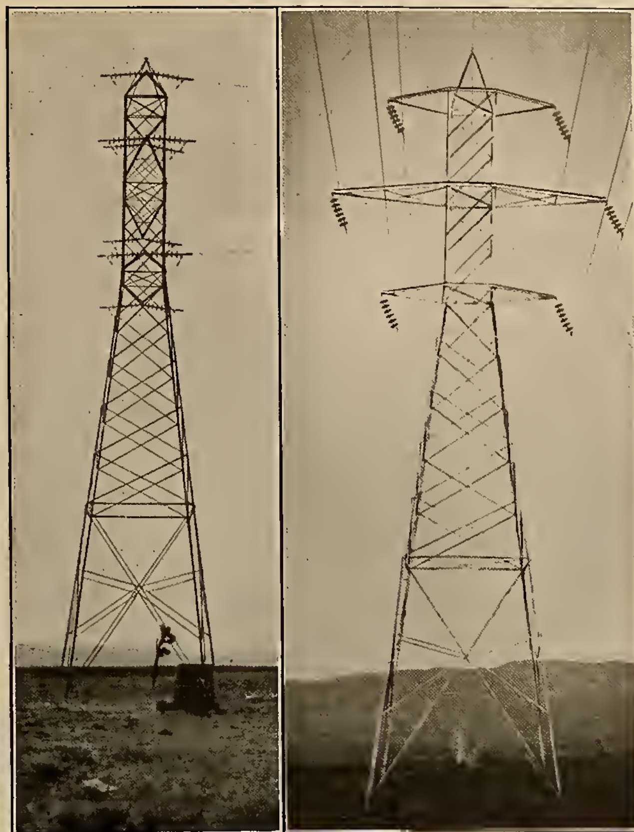
Pumping Plants.

Views in two typical pumping plants near Perris are shown. Three plants are generally housed in a corrugated iron building, the one shown being 20 x 60 ft. The length is due to the necessity of belting to the pump. The motor and equipments are held as near to a standard as possible. In this case, a General Electric 30 h.p., 2200 volt, 850 r.p.m. motor is used, and is belted to a Pomona double acting deep well pump. The switchboard in one panel carries a Westinghouse polyphase wattmeter. The motor wiring is brought from the pole to the switchboard and motor in steel duct. The strongest competitor in this district is the gasoline engine run on "tops," a low grade of distillate. Notwithstanding that this is so cheap as to make its cost little more than the freight, the motor by its safety, cleanliness and practically no cost of upkeep is rapidly displacing the engines. An illustration of this is shown where the motor has been installed ahead of a gas engine of equal power, which is now idle.

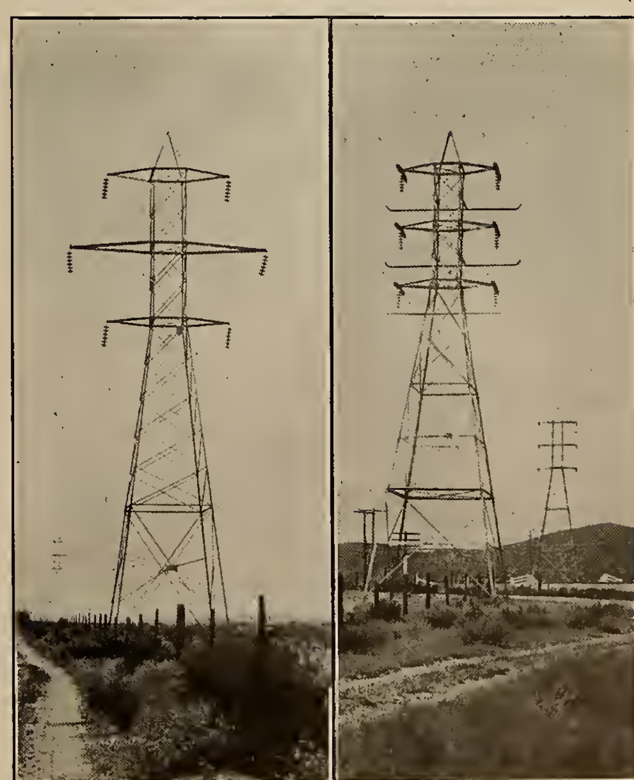
Transmission Line Specifications.

In the design of the transmission lines, while types of towers in general use have become more or less standard, it was considered that some conditions to be found on this system would necessitate refinements in many parts and much thought and time has been expended by the engineers to produce the desired results.

The towers for the main transmission line were supplied by Milliken Bros. of New York and conform in general with a type supplied for many systems by this company. Except where special requirement necessitates greater strength or additional height a standard structure of light weight is used. This follows the usual design of four corner angles 3 x ¼ and 2¾ x ¼ in., which at the ground line are 15½ ft. apart, incline toward the center until at the lowest crossarm they are 4½ ft. apart. From this point to the upper crossarm, the corners are parallel, the distance being 20 ft., beyond which the angles meet in the center



A Dead-End Tower (Left). Effect of Heavy Wind on Transmission Line (Right).



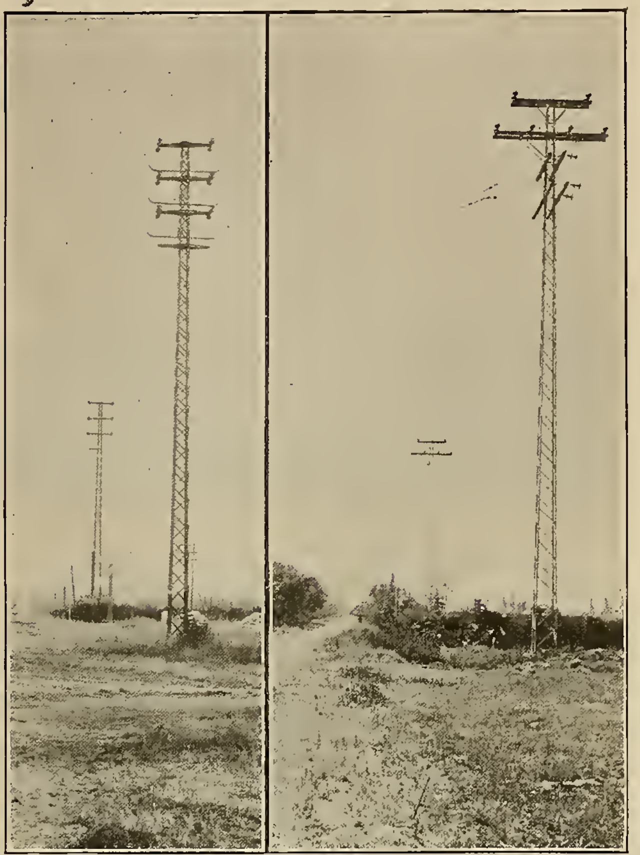
Standard Transmission Tower (Left). Special Towers at Santa Fe Railway Crossing (Right).

and form the support of the ground wire. The upper and lower crossarms are formed of two 4 in., 5¼ lb., channels, which come together at their extremities. These arms are 16½ ft. long. The middle crossarm is longer than the others, formed of 5 in., 6½ lb. channels, and measures 26½ ft. The height from the

ground to the lower crossarm is 44 ft., and to the top of the structure 70 ft.

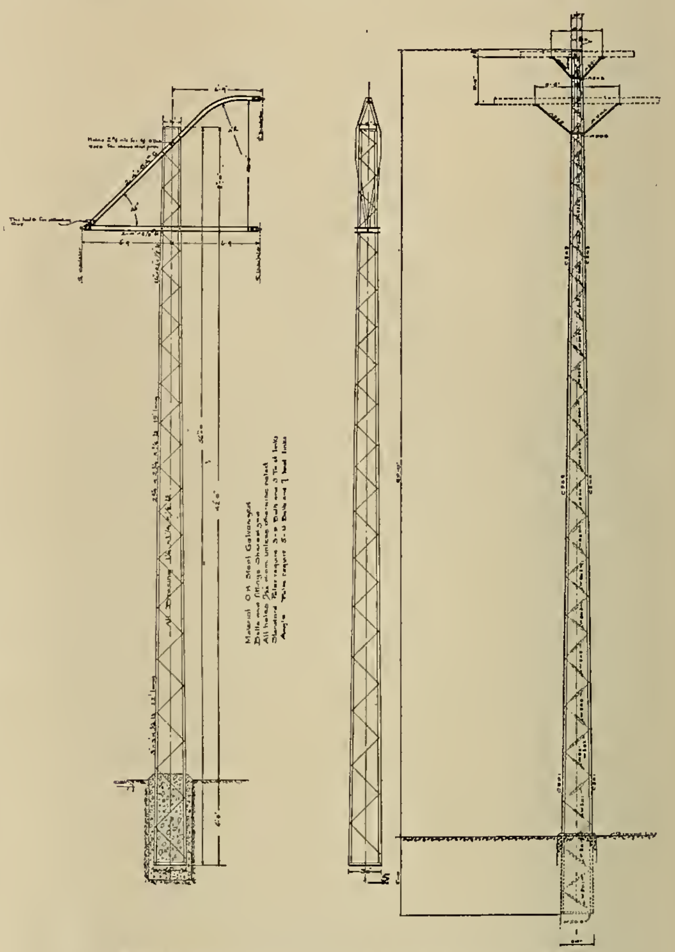
To the bottom of the corner angles are bolted the legs which are also 3x ¼ in. angles. These are 6½ ft. long. On the bottom of each leg is a ground plate. This plate is a piece of 12 in. channel 2 ft. long.

In fastening the channel plate to the leg, a right-angled hole is cut in the web of the channel which the angle exactly fits. Two flat pins set edgewise to the channel web are passed through both sides of the angle



Special Steel Poles at Railway Crossing (Left). Standard Steel Poles of 36,000-Volt Distribution (Right).

through holes properly punched. One of these pins is below and one above the channel web. The towers, except in some special cases, were first erected without concrete around the bases, it being found that much of the ground encountered was sufficiently compact to hold the tower under any probable strain. In some stretches, particularly west of Owens lake and for a good many miles to the southward, violent winds occur at certain times of the year and there is even danger of washouts from cloudbursts in the mountains nearby. For this reason long stretches of the line have been concreted around the tower legs. This is an extensive undertaking, expensive and annoying and one that no company desires to make unless positively necessary. This is especially the case here where the cost of cement is high and all water used must be hauled. The accompanying view shows a gang at work placing concrete. The water wagon with a pump mounted behind is in the background. In doing the work a preliminary gang goes ahead, guying the tower from both sides, then digging the earth from around the legs until the full depth is reached and the channel plate is hanging free. These holes are about 3 ft. in diameter. The weight of the tower is carried by timbers placed under four 3 x ¼ in. steel angles which are bolted around the base of the tower at the ground line. These angles being used only on concreted towers as stiffeners. Another gang distributes materials at each tower, cement, sand, and sections of 12 in. stovepipe. The concrete is first laid in the bottom of the holes to a thickness of 6 in.



Two Elevations of Wishbone Poles at Left. Elevation of Steel Pole for 36,000-Volt Circuits on Right.

under the channel and then 18 in. over it. The sheet iron stovepipe sections are then placed around the leg up to the ground line and these are filled with concrete. The hole is then refilled with earth. As soon as the concrete has become hard the guys are removed from the tower.

Where possible about 30 per cent of broken rock was used in the concrete mixture, but the plan was to adhere as nearly as possible to a 1 to 6 mixture. The cement requirement was about 1 bbl. per leg at a cost of $4.50 to $5 per bbl., and the total cost including overhead charges averaged $70 per tower or $560 per mile.

Dead-end towers are of frequent occurrence. A table is given under the subject of line specifications which shows the method of determining dead-ends. These towers are also used at transpositions and railroad crossings.

There are four types of special towers, all of greater weight than the standard towers; one of these

is for special dead-end strains, one for Southern Pacific crossing requirements and one for Santa Fe crossing requirements. The accompanying table gives the weights of all of the towers. The Southern Pacific requirement is conservative and probably heavier than necessary for any probable strain. The Santa Fe requirements is evidently based on bridge specifications without attempting a study of the probable strains. The weight and cost are excessive.

Classification.	No.	Unit Weight. Pounds.	Total Weight. Pounds.
Standard	1788	3,640	6,511,960
Angle	22	4,560	100,320
10-ft. Extensions	34	4,640	157,760
Transportation	8	4,000	32,000
S. P. Co. Crossing	10	6,700	67,000
Santa Fe Railway Crossing	11	11,400	125,400
Totals	1874		6,994,440

Tower Tests.

Tests on the various towers were made before the line was put in service, part of these tests being made in the East at the point of manufacture and part locally. In the determination of the hold which the channel plate on the bottom of the legs resisted the attempt to pull out of the ground vertically, a tackle was rigged to exert a vertical pull with the leg and channel buried in molders sand, considered an extreme condition for weakness of hold. These tests showed failure on an average pull of 35,000 lb., and the material broke out in a cone 30 degrees from the vertical.

The normal strain at the end of the crossarm, under the worst conditions is about 300 lb. Where three wires are broken, the maximum strain which would occur on the end of the long arm does not exceed 4500 lb. Horizontal tests with a pull at the end of the long arm, failed by the twisting of the corner members of the tower with a pull on the arm of 16,000 lb.

The following representative test made by Mr. C. O. Poole on standard towers at the manufacturers' plant gave the following results:

Test No. 6. Breast Pull on Tower Applied at Elevation of Middle Crossarm.

Load. Pounds.	Deflection. Inches.	Set.
2,000	0.25	
4,000	0.60	
6,000	0.75	
8,000	1.10	
8,500	1.20	
9,500	1.30	
11,000	1.40	
12,000	1.60	0.25 in.
13,000	2.12	
14,000	2.25	
15,000	2.50	
16,500	3.50	Failed

Towers are regularly spaced 660 ft. apart, or 8 to the mile.

Wishbone Poles.

The wishbone type pole follows a design by Manifold & Poole, engineers, and like the towers, were built by Milliken Bros. This pole is a compromise between the tower and the ordinary pole, to be used where spacing is necessarily somewhat closer than with the towers, where one circuit only is to be carried and strength and rigidity and permanence of a steel structure is desired. The pole consists of four angles in sizes 3 x 1/4, 2 3/4 x 3/16 and 2 1/4 x 1/8 in., spaced at the butt 30 in. apart and at the top 16 in. The corner angles are held in position and braced by steel angle latticework. These angles are placed diagonally in both directions, averaging every 24 in. and on all four sides using 1 1/4 x 1/8 in. angles. The length of the pole is 56 ft. There are two crossarms, each formed of a pair of steel 4 in., 5 1/4 lb. channels. The lower arm is horizontal, 13 1/2 ft. long. The upper arm is curved for a part of its length. One end is bolted to the shorter end of the horizontal arm, the center is bolted to the top of the pole, while the curved half of the arm extends to one side. This odd connection of crossarms has somewhat the appearance of a wishbone, hence the name. By the arrangement a triangle is formed by the ends of the arms. These poles are placed in the ground to a depth of 6 ft. and the holes are filled with concrete.

Wishbone poles are used for the feeder circuits from No. 3 and No. 6 powerhouses to the control station, there being altogether 5 1/2 miles of this line in place. These poles are spaced 12 to the mile. The weight is 1700 lb. each.

The insulator equipment of all the 140,000 volt circuit consist of 6-part suspension insulators. With the exception of ten miles the tower line is equipped with Locke No. 2036 insulators. The remaining ten miles and the Wishbone lines are equipped with Ohio Brass Company, No. 10567 insulators.

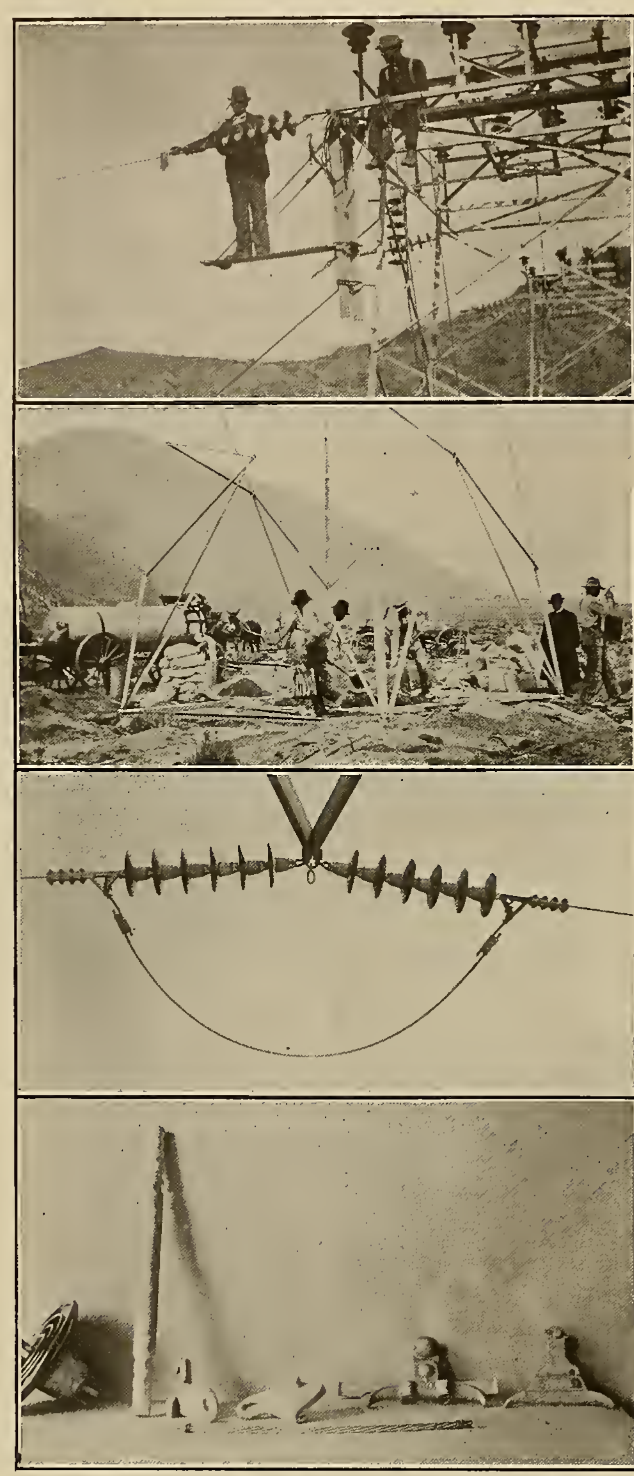
Where the lines are carried over railroad crossings, the poles or towers on either side of the crossing are equipped with three curved guards made of steel channels. These are supported from the structure by channel brackets. In the instance of the towers, these channels stand 4 ft. out from the body of the tower. They serve to ground a broken wire in falling which will first strike this guard. On towers equipped with guards and also towers next to a line switch, the middle arm is made the same length as the others.

Of the 33,000 volt distributing lines from San Bernardino, there are about 14 miles of steel poles. These have a length of 60 ft. and are formed, like the wishbone poles, of four angles and lattice angles.

The corner angles are 2 1/2 x 3/16 in., 2 1/2 x 1/8 in., and 2 x 1/8 in., the lattice angles being 1 1/2 x 1/8 in. These poles carry two wooden crossarms, the upper one carrying two pins and the lower four, for the support of two circuits. At railroad crossings and on corners a considerably heavier construction is used although the pole is of the same outline design. These poles are spaced 12 to the mile. For all other circuits, 35 and 40 ft. cedar poles are used with standard single and two arm construction. All structural steel throughout is galvanized and all bolts are sheerardized.

A wooden pole telephone line has been built from the control station to San Bernardino. This was built expressly for the purpose of keeping the signal line

entirely free from the transmission, and, to obviate possible inductive effects the line, while parallel to, averages at least one mile distant from the transmission. This line consists of 30 ft. round cedar poles, spaced 25 to the mile. Each pole carries one two-pin crossarm and carries two No. 8 hard drawn copper



Method of Fastening Conductors at Dead-End.
Placing Concrete Footings About Tower Legs.
Near View of Dead-End Connection on Tower.
Insulator Section, Wire Connector, Wire Clamps and Guy Clamps.

wires. It is operated with both telephone and telegraph equipment simultaneously and part of the line is used by arrangement with the Interstate Telephone Company for commercial messages.

The circuits on the wishbone poles and also on the 33,000 volt distribution are copper wire, the former being No. 0, 7-strand, while the latter is in various sizes depending upon the service.

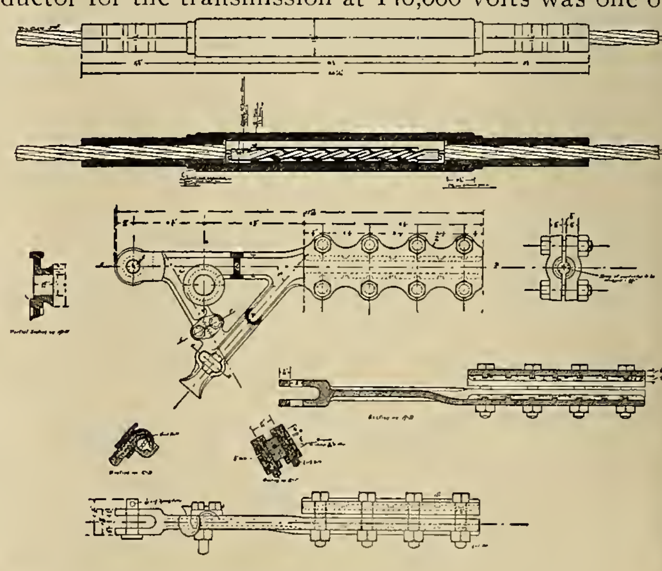
Special Line Fittings.

There are a number of special fittings for wire connections to towers and insulators. These consist of cast steel clamps in various forms to be used where a guy wire is fastened to a tower, the clamp being so shaped as to conform with a joint between angle members and containing an eye for fastening the wire. In fastening the aluminum steel conductor it was necessary to provide a means of fastening the steel core and the aluminum strand independently. Dead-end clamps consist of a malleable iron clamp with eight bolts and an aluminum lining. There is an offset terminated by a single "J" bolt clamp, through which the aluminum wires are brought and from which connection is made to the jumper. The steel core wire is carried straight back and fastened through a hole provided in the casting. The end of the casting is provided with an eye for a ⅝ in. bolt to fasten to the insulator.

The line connectors consist of a cast aluminum cylinder having an inside diameter somewhat larger than the conductor. The ends of the cylinder are smaller and just pass over the cable, and one of these ends is screwed into the main body of the cylinder while the other is cast solid. The ends of the conductor are untwisted, a standard joint is made between the steel wires, the cylinder is then slipped over the conductor until the steel wire joint is inside and the loose end is slipped down from the opposite direction and screwed into the cylinder, the aluminum wires extending into the cylinder from both ends, but not held tightly. A specially constructed hydraulic vice is brought to bear on each of the ends and these are squeezed down tightly around the aluminum conductors making a joint which developes the entire strength of the wire.

Aluminum-Steel Conductors.

The problem of a proper and satisfactory conductor for the transmission at 140,000 volts was one of



Details of Aluminum Wire Connector and Dead-End Clamp.

no mean study and this has been very carefully considered. The use of so-called aluminum-steel conductor fulfilled the requirement due to electrical phenomena encountered in the use of extreme voltages, such as corona loss, also the mechanical properties necessary. Due to its newness little was known from experiences on other systems. The electrical and mechanical features were carefully worked out and a system of standards adopted in placing this wire and the results seem to be satisfactory and in accordance with the calculations of the engineers.

The following electrical and mechanical data given by Messrs. Manifold & Poole, showing the method followed in making calculations and the results obtained.

Actual length of line	238.16 miles
Actual length measured along wire	239 miles
Weight of aluminum-steel conductor in line (6 wires)	2,197,000 pounds
Equipment of lines:	
Insulators	12,948
Dead end clamps	3,072
Parallel groove clamps	3,072
Suspension clamps	9,876
Guys (guys on tangents come off when towers are corrected)	550
Ground wire	147 miles
Concrete	2,302 cu. yds.
Line Constants:	
Cross section 6 aluminum strands	211,160 c. m.
Cross section 1 steel strand	34,970 c. m.
Cross section cable	246,130 c. m.
Weight per ft. of cable	0.29 pound
Diameter of cable (0.5622 in.)	9/16 inch
Average distance between wires	168 inches

L = Inductance = 2.14 millihenries per mile.
C = Capacity = 0.014 microfarads per mile.
X = Reactance = 0.98 ohms per mile.
b = Cap. Susceptance = 0.0000053 ohms. per mile.
r = Resistance = 0.42 ohms per mile.
ε = P. F. angle of line = 67°.
z = Impedence = 0.45 ohms per mile.

Kilowatts delivered to Receiver.	Receiver Voltage 60,000.		Receiver Voltage 87,000		Receiver Voltage 140,000	
	Percent Variation	Generated Voltage	Percent Variation	Gener'td Voltage	Percent Variation	Gener'td Voltage.
0	16.3% rise	43000	15.3% rise	74800	16.3% rise	120300
1000	11.0% "	45000	14.2% "	76000	15.8% "	121000
2000	6.1% "	47100	12.1% "	77600	15.0% "	121900
3000	.5% "	49700	10.3% "	78700	14.0% "	122800
4000	4.8% drop	52600	8.8% "	79900	13.2% "	123500
5000	10.6% "	56000	7.3% "	81000	12.7% "	124200
6000	19.6% "	69800	6.8% "	82200	12.2% "	124800
7000			4.2% "	83400	11.6% "	125500
8000			2.8% "	84600	11.0% "	126200
9000			1.0% "	86100	10.4% "	126900
10000			.7% drop	87700	9.5% "	127700
11000			2.5% "	89300	9.0% "	128400
12000			4.4% "	91000	8.3% "	129200
13000			6.3% "	92800	7.7% "	130000
14000			7.9% "	94500	7.1% "	130700
15000			9.7% "	96300	6.5% "	131500
16000			11.4% "	98200	5.8% "	132400
17000			13.0% "	100000	5.0% "	133200
18000			15.4% "	102900	4.3% "	134100
19000			16.0% "	103500	3.8% "	135000
20000			17.7% "	105800	3.0% "	136000
21000					2.4% "	136900
22000					1.6% "	137900
23000					.9% "	138900
24000					----	139900
25000					.6% drop	141000
26000					1.3% "	142000
27000					2.2% "	143000
28000					2.7% "	144000
29000					3.5% "	145000
30000					4.0% "	146000

Table of Calculated Line Regulation at 80% Power Factor.

The aluminum-steel cable is made in a single strand of seven wires, the six helical wires of aluminum and the center or core wire of steel of unusually high tensile strength.

Following is a table of characteristics of this cable:

	Wt. per ft. lb. Each wire.	Wt. per ft. lb. Total.	Modulus of Elasticity.	Elastic Limit. Lb. per sq. in.	Coefficient Expansion Deg. Fahr.	Ult. Ten. Strength Each wire lb.	Ult. Ten. Strength Total lb.
Steel	0.0935	0.0935	30,000,000	130,000	0.0000064	3,560	3,560
Aluminum	0.0325	0.1950	9,000,000	14,000	0.0000128	384	2,304
Total		0,2885	12,000,000		0.00001052		5,864

Deflection.

In stringing the cable a tension of 1500 lb. at a temperature of 70 deg. F. was adopted. It was found that a stretch of one-tenth of one per cent was necessary before the outer aluminum strands came in contact with the steel core. Beyond this point the metals act together. To give this initial stretch to the steel required a strain of 833 lb.

On the preceding assumption, the following figures were made for a 1000 ft. span:

Using the formulas, $$d = \frac{c^2 W}{8 t}$$

$$L = c + \frac{8 d^2}{3 c}$$

Where:

L = length of wire in span.

d = deflection in feet.

c = span in feet = 1,000.

W = weight per ft.

T. = temperature.

t = tension in lb.

$t_1 = t - 833$.

s = total stretch, $= s_1 + s_2 + s_3$.

s_1 = stretch due to t_1 acting on whole cable.

s_2 = stretch due to 833 lb. acting upon steel core.

s_3 = stetch due to temperature T.

1. Find the deflection with a tension of 1500 lb. 70° F. = 24.2 ft.

2. Find the length of the wire in the span with the above deflection = 1001.556 ft.

3. Assume that the length of the wire is released from any tension and reduced in temperature to zero, assumed as the lowest that may be expected on the line. The length will be found to be = 999.534 ft.

4. The difference between 2 and 3 gives 2.022 ft., as the stretch due to a strain of 833 lb. acting on the steel core having a modulus of elasticity of 30×10^7 and allowing a stretch of 1 ft. to the wire, plus the stretch due to 1500 — 833 = 667 lb., acting on the whole cable, with a modulus of elasticity of 12×10^6 and giving a stretch of 0.286 ft., plus the stretch due to temperature, with a coefficient of expansion, of 0.00001052, which gives a stretch of $0.00001052 \times 1000 \times 70 = 0.736$ ft.

5. Select suitable deflections, and, working backward along the above lines, find corresponding temperatures. A table may then be prepared as follows:

Span: 1000 ft. Actual length of cable stressed at 0° F. = 999.534 ft.

L.	d.	t	t_1	s	s_1	s_2	s_3	T.
1001.556	24.2	1500.	667.	2.022	0.286	1.	0.736	70.0° F.
1001.290	22.0	1650.	817.	1.756	0.350	1.	0.406	38.6° F.
1001.066	20.0	1814.	981.	1.532	0.420	1.	0.112	10.6° F.
1001.805	26.0	1395.	562.	2.271	0.241	1.	1.032	98.0° F.
1002.090	28.0	1295.	462.	2.556	0.198	1.	1.358	129.0° F.

By plotting the above table on cross section paper, the deflection due to any temperature can be determined.

The following table has been compiled from the preceding method:

TABLE OF SAGS
ALUMINUM STEEL CABLE
Sierras Construction Co., June 17 1912

SPAN	TEMPERATURE FAHR. 0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°
500	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.5	7.0	7.4	7.9	8.4	8.8	9.3	9.8
550	4.1	4.5	4.9	5.4	4.8	5.3	6.8	7.3	7.8	8.4	8.9	9.4	9.9	10.3	10.8	11.3
600	5.0	5.5	6.0	6.6	7.1	7.6	8.1	8.7	9.2	9.8	10.3	10.9	11.5	12.0	12.5	13.0
660	6.4	7.0	7.6	8.2	8.7	9.3	9.9	10.5	11.1	11.7	12.3	12.9	13.5	14.0	14.6	15.2
700	7.4	8.0	8.6	9.2	9.8	10.4	11.0	11.7	12.3	13.0	13.6	14.3	15.0	15.5	16.1	16.7
750	8.9	9.6	10.3	11.0	11.6	12.2	12.8	13.5	14.2	14.9	15.5	15.2	16.9	17.5	18.1	18.6
800	10.4	11.1	11.8	12.5	13.2	13.9	14.6	15.3	16.0	16.7	17.4	18.1	18.8	19.4	20.0	20.6
850	12.2	12.9	13.7	14.5	15.2	15.9	16.6	17.3	18.0	18.7	19.0	20.1	20.8	21.5	22.2	22.8
900	14.0	14.8	15.6	16.4	17.2	18.0	18.8	19.5	20.2	21.0	21.6	22.3	23.0	23.6	24.3	25.0
950	16.2	17.0	17.8	18.6	19.4	20.2	21.0	21.6	22.3	23.0	23.6	24.3	25.0	25.6	26.3	27.0
1000	18.4	19.2	20.0	20.8	21.6	22.4	23.2	24.0	24.8	25.6	26.2	27.8	27.5	28.1	28.7	29.4
1050	21.0	21.9	22.8	23.6	24.4	25.2	28.0	26.6	27.3	28.0	28.6	29.3	30.0	30.6	31.3	32.0
1100	23.6	24.5	25.4	26.2	27.0	27.8	28.6	29.3	30.0	30.7	31.4	32.1	32.7	33.2	33.7	34.2
1150	26.6	27.4	28.2	29.0	29.8	30.5	31.2	32.0	32.7	33.4	34.0	34.6	35.2	35.8	36.4	37.0
1200	29.5	30.3	31.1	31.9	32.6	33.3	34.0	34.7	35.4	36.0	36.7	37.4	38.0	38.5	39.0	39.5

SOUTHERN SIERRAS POWER CO. MANIFOLD & POOLE, ENGRS.

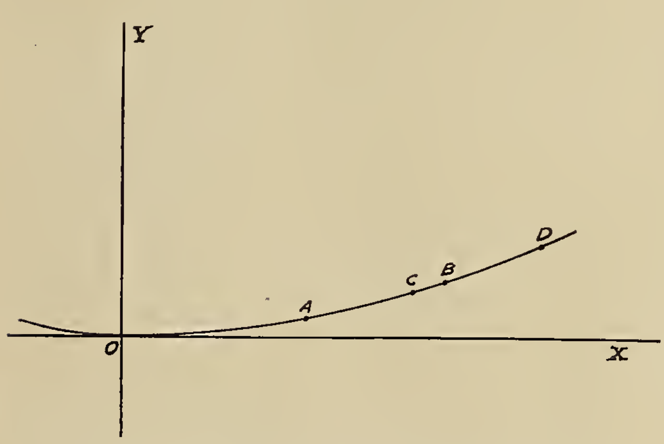
Dead-Ending.

At all horizontal angles over 2 degrees the lines have been dead-ended and jumpers used connecting and continuing the circuit around the insulators. This practice is also followed on long tangents, where dead-ends are introduced about every five miles. In depressions where a shortening of the wire due to low temperatures might cause uplift on the insulators of the low tower, dead-ending has also been resorted to. To determine, before stringing the wire if the lines on a tower in a depression would require dead-ending, the following method was devised; upon determining that the tension on the wire at zero temperature would be 2500 lb.

A curve $y = \dfrac{W\,x^2}{2\,h}$ is drawn,

where

W = weight of wire per unit of length.
H = tension in cable at lowest point and constant horizontal tension throughout.



It will be seen that if two adjoining spans overlap, there is no upward resultant, as, for instance, A—B and C—D. If they do not overlap, there is an upward resultant and a dead end is required.

Example: Let the angle of slope A to B = 2°, and from C to D = 8°, the distance from A to B = 600 ft., and from C to D = 800 ft.

$$\frac{dy}{dx} = \frac{Wx}{H} = \frac{0.288\ x}{2500} = \tan 2^\circ$$

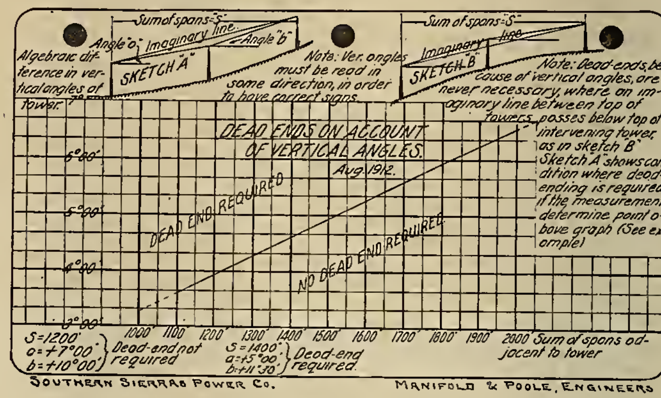
Whence x = 303 ft. = distance from 0 to center of span A—B;

Likewise x = 1203 ft. = distance from 0 to center of span C—D;

Then 1203 — 303 = 900 ft. which equals the distance from center to center of spans along the curve. Hence with the span given, dead-ending would be required.

If however, both spans were 1000 ft., dead-ending would not be required.

From this method the following curve for field use has been compiled.



Field Chart for Determining Dead-Ends.

Both transmission circuits are transposed three complete turns, between the control station and the San Bernardino terminal. Transpositions are accomplished on one tower somewhat heavier than the standard tower and carrying besides three double sets of insulators for dead-ending, on each circuit, three additional sets on the jumpers. There are eight transposition towers.

A ground wire is carried above the circuits and is clamped solid to the top of the tower structure. This is a 3/8 in. Siemens-Martin double galvanized steel strand, of seven wires with an ultimate tensile strength of 6800 lb.

Nevada-California Company Transmission Lines.

What has been said as to the nature of the territory over which the Southern Sierras transmission lines are carried might apply equally well to a comparatively large area in the western part of the "Sagebrush" state. This part of Nevada is famous for its gold mining activity and particularly the rapid growth of this industry within recent years. It was to supply an insistent and rapidly growing need for power in Goldfield, Tonopah and the districts surrounding those cities in the years of 1904-5, that the nearest available water power was developed on Bishop creek and a transmission line built. Even as recently as the date named the development of the long distance transmission of power was in no wise advanced to the state in which it is found today and many intricate problems were encountered which today would appear as matters of routine. The power plant which was built at this time, now known as No. 4 in a series of five plants now installed on Bishop creek has been already described in the first part of this article. The transmission line which was at that time built consisted of a

Silver Peak Substation in the Nevada Desert.

single 3-wire circuit mounted on wooden poles. This line was unique in that a cross arm carrying two of the wires of the circuit was bolted in the usual manner to the top of the pole, while an extension in the form of an inverted "U" made of a 4 in. steel channel was bolted to the poletop so that on the bend, which is at the highest point, was placed the insulator carrying the third wire. This odd construction was adopted to get sufficient ground clearance and still use 35 ft. poles, the cost of poles being high in this country, and this device being less costly than a longer pole. This line after leaving the power plant crosses the Owens valley ascending the slope of the White Mountain range bounding this valley on the east, and crossing the summit through a pass at an altitude of over 9000 ft. Several desert valleys and ranges are crossed in a general northeasterly direction until, at a distance of 51 miles from the generating plant the switch house at Palmetto is reached, thence 17 miles to Silver Peak substation and switchhouse and thence continuing a further distance of 18 miles to the Alkali sub and switching station. From this point the line divides, one branch going to Goldfield and the other to Tonopah.

From the power house to Alkali the circuit is a No. 0, 7-strand aluminum conductor. The insulators are Locke No. 352 and have been tested to 90,000 volts. The conductors are placed in an equilateral triangle with reference to each other, the sides of which are 6 ft. The poles are spaced 17 per mile. There are a few spans, the longest of which is 475 ft. The Goldfield line from Alkali has a length of 9 miles and the conductor is No. 2, 7-strand aluminum. The Tonopah branch has a length of 18 miles and is similar to the main line to Alkali.

New discoveries of gold at Bullfrog and Rhyolite, about 80 miles south from Goldfield was the cause of great excitement in the year following the construction of the first line, and in 1907, in response to a demand for power in those districts, the transmission

Substation and Arrester House at Goldfield.
Substation at Millers.
Switch House and Substation at Alkali.

Substation at Tonopoh.

was extended from Palmetto switching station to Rhyolite, a distance of 73 miles. This line is also similar to the first line built.

In the following year, the line first built was loaded to its capacity and a second circuit was constructed from the power house, through the Palmetto station to Silver Peak and an extension was built to Millers a distance of 30 miles. The new line differs from the old in that the circuit is of No. 2, 7-strand aluminum, and the poles are framed in the usual manner, not using the "U" shaped channel, and with the top pin at the top of the pole, otherwise these lines are similar. The line from Silver Peak to Millers carries a circuit of No. 0, 7-strand copper. In 1909 an extension was built from Millers to Manhattan, another mining town which had a spectacular development just before this time.

The distance of transmission from San Bernardino over the Southern Sierras system and thence over the lines of the Nevada-California system to Rhyolite is just 400 miles and recently these lines were so tied together and operated at 55,000 volts potential, the power being supplied from the San Bernardino steam station. This parallel operation of these systems worked very satisfactorily.

Nevada-California Company's Substations.

The Palmetto switch house, at which point the line to Rhyolite branches is a steel frame building covered with corrugated iron. The floors are concrete and the high tension switches are placed on elevated reinforced concrete platforms suppored by steel columns similar in manner described for some of the power plants.

Nevada-California Power Company's Nevada Headquarters at Goldfield.

The main lines after entering the building connect to a cross bus through single pole disconnecting switches.

Substation at Manhattan, Nevada.

The lines leaving the house are each controlled by Pacific Electric Manufacturing Company oil circuit breakers. The Rhyolite line is controlled by a Kelman 60,000 volt automatic circuit breaker. The outgoing lines are also equipped with single pole disconnectors. A cottage for an attendant adjoins this station and the surrounding plot of ground has been carefully planted with shrubs and trees. A view of this station shows well the nature of the surrounding country.

Type of Home Built by the Companies for Operators.

The substation and sectionalizing house at Silver Peak is corrugated iron over a steel frame. The entering lines are equipped with Pacific Electric air-break switches and Siemens horn-gap lightning arresters are connected to these circuits between the switches and the station building. One of the circuits leaving this station continues, supplying Alkali and thence Tonopah and Goldfield, while the other extends to Millers. There is also a 6600 volt circuit from this station which supplies the Silver Peak Gold Mining Company's property a distance of 5 miles at which point current is supplied for operating a large gold mine and mill. This circuit also supplies a lighting system in the town of Blair. The substation contains three 500 kw. Westinghouse self-cooling oil insulated transformers, equipped with auxiliary water cooling coils for overload or extreme heat conditions. The local distributing voltage is adjusted by means of a three-phase hand controlled voltage regulator. Outside of the building is installed a set of General Electric 55,000 volt electrolytic lightning arresters.

The alkali station is a reinforced concrete building in the style followed in the power houses. The Tonopah and Goldfield lines leave the building from opposite gables, while the main line enters at the side. On each of the branch lines, before leaving the building, are installed a set of Kelman oil circuit breakers. There are also in this station three 50 kw., 55,000 to 6600 volt lowering transformers. These supply power to pumping plants in the immediate vicinity. In a separate building are a set of General Electric electrolytic lightning arresters.

The Goldfield substation, the first to be built on this system, is a very substantial stone building. Its location is on the outskirts of the city somewhat north of the main business section at a point convenient as a center of distribution to the power business which developed rapidly upon its installation. The main line enters, after passing through choke coils mounted on a pole, through Kelman oil circuit breakers to which connection is made to a bus line extending throughout the length of the interior of the building. The transformers placed on the main station floor are supplied directly from the high tension bus. There is one bank of three 500 kw., Stanley-G. I. self cooled, 55,000 to 6600 volt lowering transformers, and a second bank of three 750 kw., General Electric transformers of the some voltage ratings. All of these transformers are supplied with auxiliary water cooling coils, to maintain safe temperature conditions during hot weather or overloads. The water for cooling is circulated through a cooling tower and thus is used over and over again. Near the main substation building is a reinforced concrete arrester house which contains a set of General Electric 55,000 volt electrolytic lightning arresters. Line connection to these arresters is made in the conventional manner through horn gaps. There are three 6600 volt circuits passing from the substation, two of these supplying power for mining operations and a city

service for Goldfield, while the third supplies Diamondfield and the district surrounding. A General Electric arc regulator set in the substation supplies a street lighting circuit for the city of Goldfield.

The substation at Tonopah, also one of the first to be constructed, is quite similar in style to the Goldfield station. The transmission line branching at the Alkali switching station, enters the building after passing a Pacific Electric outdoor type switch, thence through disconnectors within the building, connection is made to a cross bus. A transmission circuit from the Millers substation enters the opposite side of the building and in a similar manner to the one already described, and connects to the cross bus, through disconnectors. A Kelman oil circuit breaker in the bus line connects both ends and thus permits the paralleling or separating of the two main transmission lines, it being therefore possible to supply this station either direct or via Millers or both. There are installed in this substation three 300 kw. and three 500 kw., Stanley-G. I. 55,000 to 6600 lowering transformers, and a bank of three 500 kw. Westinghouse transformers of the same voltages. These transformers are all self-cooling but are equipped with water circulating coils to be used in the prevention of excessive heating. Following the recent practice of this and the allied company, the latter set of transformers have been equipped with weather proof covers and entrance bushings and will be placed outside of the station. Eventually all of the transformers will be so equipped and placed leaving the building to be used for switching purposes and as a dwelling for the operators. Four distributing 6600 volt circuits from this station cover the adjoining territory several miles in radius and supply, not only power to mining plants but also light and power to the city. An arc lighting system similar to the Goldfield system is installed here.

At Millers the substation is of corrugated iron over a steel frame. The line from Silker Peak enters one end, passing through a Kelman non-automatic oil circuit breaker, while from the other end is taken the line which goes to Tonopah a distance of 18 miles. A set of Siemens horn gap arresters is installed near the building while within is a set of General Electric electrolytic arresters. There are at this point three 500 kw. Westinghouse, self-cooling lowering transformers, with 55,000 volt primary and secondary giving 6600 and 2200 volts, equipped with auxiliary cooling coils. A branch transmission line to Manhattan 34 miles, is controlled by a Kelman automatic regulator. The local distribution from this substation supplies the reduction works of the Tonopah Milling Company, the Belmont Milling Company and an ore sampling plant, these works handling a large part of the output from the gold mines of the Tonopah and Goldfield and numerous other mining districts.

The substation at Manhattan is of reinforced concrete in the style of the power house buildings and makes a neat and artistic appearance. Within this station, besides a set of General Electric electrolytic lightning arresters is a bank of three Stanley-G. I. 300 kw. self-cooled transformers of the usual voltage ratio of 55,000 to 6600 volts. From this station two 6600 volt circuits supply the immediate surrounding locality. The third circuit extends to Round Mountain, a distance of 13 miles supplying mines and mills in that district. A line voltage of 11,000 is used on this circuit and this is obtained through a star connection of the 6600 volt secondaries of the lowering transformers. The lower voltage conections are taken from taps in the secondary windings.

The remaining substation is at Rhyolite and follows the general plan of construction which has been consistently adapted in this system.

The Nevada headquarters for this system is at Goldfield where a two-story building of concrete blocks with a cement covering contains the various offices. On the lower floor is a well equipped display room and the cashier's and superintendent's offices. The upper floor is devoted to the offices of the various departments.

The writer is particularly indebted to Mr. C. O. Poole and Mr. R. G. Manifold engineers for the Southern Sierras Power Company for their assistance in gathering data for this and the preceding article, and to many others in the employment of the company for courtesies shown.

CO-OPERATION IN THE CORPORATION.

BY M. H. GREGG.[1]

Corporation and co-operation are two words that sound similar. They are not only alike phonetically, they are inseparable from the standpoint of modern business ethics. Co-operation may exist without corporation, but corporation can only exist through co-operation. As a proof, consider the working organization of a corporation. We all realize the necessity for an organization of men to handle all large business interests. There are a great variety of problems with which to deal, and it is just as impossible for one man to be able to solve each one of the problems in all its ramifications as it would be for one man, in modern days, to constitute a whole government.

This limitation of individual ability is especially noticeable in our modern public utility corporation. We need men in our organizations to perform a very wide range of work, such as executives, salesmen, technical engineers, practical engineers, office help of varied experience and plain laborers. It is necessary where such a number of men are working for a common interest, to have them divided into groups or departments headed by officers or department heads. An officer or a department head is a man who is supposed to know more than the men under him do about the work in general. It is always safe to assume that the man above knows more about the business than his subordinates. If he doesn't, he will not remain above them very long. Anyway, the assumption will not cause a subordinate any harm and may save him much trouble. There are very few cases where officers or department heads have received their appointments when not merited.

Now, if we analyze the departments, we find that different personalities are necessary for their successful make-up. Where you find a department containing opposite natures under the control of an officer, you will usually find a department which

[1]Division Manager United Light & Power Company, Oakland, Cal.

is very effective in its work. Having seen that the individual is so important in the corporation's life, it follows that each man's views should be given consideration. No employe of a corporation should hesitate to give his views of the corporation's affairs arising in his department. He should support these views with facts and work hard for their adoption. If his views are accepted, he is the gainer. If his views are not adopted, he has lost nothing. How can a corporation that depends upon an organization, in which so many different types of men are needed, make any progress unless there exists among these men a spirit of co-operation; a spirit of helpfulness? Co-operation is the electricity which runs the motor corporation. It is generated by broad-minded action. Its generator must be in phase with the current in the primary line of mutual interests, before its output is of value in mingling with that of the other generators working on the line.

If co-operation is necessary for the success of the corporation, it follows it must be necessary for the success of the individuals composing the corporation. How can one best employ this spirit? If, as mentioned before, he has expressed his views on corporation affairs under advisement and has seen these views discarded, then he must subdue his own opinions regarding the performance of certain work assigned to him, because his opinions are in conflict with those of the man above him in authority, and he must throw his whole energy into an endeavor to bring success to the adopted plans. He has then overcome the greatest and practically only stumbling block in the path of co-operation. That sounds like an easy task, but its performance seems to be the most difficult thing a man has to accomplish. The period following the adoption of views at variance with his, is the critical period to which each man should give careful attention, and be very guarded in his actions. This period is fraught with danger. The danger arises in not being able to forget one's own views; in bearing animosity toward the views which have been adopted by the superior officer; and not rendering his combined efforts toward bringing success to the adopted views. Therein lies a test of character and it is a most severe one, simple though it seems, but it pays to accomplish it and to do so is absolutely necessary for the ultimate success of the individual. If one pursues the contrary method and does not render himself whole-souled to the task before him, or if he throws obstructions in the way, he is courting instant death, literally speaking, and if not fortunate enough to meet it at once and be resurrected to common sense, he will continue in a path that will surely lead to oblivion.

Business is based upon selfishness, that is we are only in business in order to gain something. When men enter business, they are selfish. In other words, they desire to gain something such as wealth, fame or the necessities of life. Now these are not, for one minute, to be considered as bad motives. On the other hand, they are good, because if it were not for the selfishness in business, there would be no incentive for industry and, we would not be an active and progressive race. Realizing that selfishness is the proper spirit to have in business, we must not overlook the fact that there is a limit to this selfishness as there is a limit to all actions, either good or bad. He is wise who knows his limit in everything. History is full of names of rulers, generals, statesmen and men of all walks of life who have failed to stop before they reached their limits. The limit in business selfishness, beyond which one must not go and which one must not reach, is the point where antagonism and animosity begin. Stepping into a friend's office one day several years ago, I read a motto which hung on the wall. Although I do not care much for mottos, this one impressed me as being very good and a realization of its import did me more good than anything else in the motto line. It read, "He who plots another man's undoing is plotting his own." Think about this and recall the examples that have come to your attention and see what your views are regarding its value. Personally, I have yet to see the example that disproves the truth of this motto. If the other fellow does not co-operate with you, let him alone. Do not antagonize him nor try to undermine him. Watch yourself, however, to see that you co-oporate with him when the opportunity presents itself. It is hard enough to get along in the business world now-a-days without being pestered with position-destroying fellow workers. The competitor outside the line keeps you sufficiently busy. Give every man a chance to succeed. If he is under you, give him help and do not strew his path with stumbling blocks, nor set traps to destroy him. If he is over you in authority, respect his views and obey his orders, no matter what your views are. In other words, co-operate. In so doing, you will first further the interests of your corporation, and secondly will protect your own interests. You enter business to accomplish the latter. The corporation employs you to do the former. Two interests have been served. Dividends are forthcoming, and a pay check appears regularly.

EXTENSION OF ELECTRIC POWER IN SOUTH AFRICA.

Great progress was made during the year by the two large electric power companies which supply motive power to a majority of the leading Rand gold mines and which, as a consequence, are closely allied to the gold mining industry. These are the Victoria Falls and Transvaal Power Co. (Ltd.) and the Rand Mines Power Supply Company. These companies, operating together, now have four large generating stations situated at Brakpan, Simmer Pan, Rosherville and Vereeniging, also a station at the Robinson Central Deep mine for generating compressed air. Additional plants have been ordered as follows: Two 11,000 kilowatt turbines at Simmer Pan; two 12,000 kilowatt turbines at Vereeniging; three 7000 kilowatt steam driven turbo air compressors at Rosherville station. When these are installed the combined capacity of all the power stations will be 140,000 kilowatt electric plant and 61,500 kilowatt air compressing plant. In addition to the above, further new construction is contemplated in connection with the Brakpan station to meet the demands of the developing gold fields of that district.

ELECTRICAL PUMPING AND IRRIGATION

STRUCTURES FOR THE DISTRIBUTION SYSTEM.

BY B. A. ETCHEVERRY.

The structures used for the distrbution system are:

1. Check gates to control or raise the water in the supply canal to divert the water into one or more branches or through an escape.
2. Headgates or turnout gates at head of canals or laterals.
3. Division boxes on small laterals or farm ditches.
4. Measuring boxes at head of private ditches.
5. Wasteways, escapes or spillways located at drainage channels.
6. Drops or rapids.
7. Drainage crossings: flumes, siphons, culverts, level crossings.
8. Road crossings: bridges and culverts.

The last four groups of structures differ only in size from those used on the main canal. These have been previously discussed and will not be considered any further. The first four groups include those types of structures which either belong only to the distribution system or differ more or less from the types of structures used on the main canals. The structures used on the distribution system are very numerous. To simplify their design and construction it is generally advisable to prepare standard designs as far as possible.

Check Gates.

Check gates are used when it is necessary to raise the water level in the canal to divert it into one or more branches or through an escape or wasteway upstream from the check gate. The use of check gates favors the deposition of silt and increases the seepage losses, hence it is desirable to use as few as possible. When the slope of the canal is flat and the branches not far apart, the use of one check gate may be sufficient to raise the level of the water to divert it in more than one branch. A check gate is often built in combination with the lateral headgate for which it raises the water surface. The check gate is usually at right angles to the lateral. On the smaller laterals or distributaries the check gate with the lateral headgate form what is more commonly called a division box. A check gate is often necessary at a wasteway and is built in combination with that structure. Examples of this form of construction are the Umatilla sand gates and Amity Canal wasteway and sand gates previously described. Drops are very frequently used as check gates by providing gates or flashboards to close the openings above the crest of the drop.

A check gate structure usually consists of a rectangular channel formed by a floor, side walls, wing walls and cut off walls, divided into one or more gate openings. The gate openings are separated by piers or columns and closed with flashboards or life gates. On the main canal of large irrigation systems the design of check gates is very similar to that of headgates.

The cross sectional area of the channel of the check gate should be made very nearly equal to that of the canal section in order to prevent the occurrence of eddies at the inlet and outlet. A simple type of check gate is the following:

The check gate on the Pawnee canal consists of five openings each five feet wide regulated by means of flashboards supported on concrete piers. For flashboard guides an iron bar is partly imbedded in the upstream face of the concrete pier. The piers rest on a reinforced concrete floor 4 in. thick. The piers and

Culvert Gate on Farm Lateral With Taintar on Radial Gate—University Farm, Davis, Cal.

side walls are also 4 in. thick and support a footwalk 18 in. wide and 2 in. thick. The vertical aprons on the upstream and downstream end extend 3 ft. below the grade of the canal. The cut-off walls on the two sides extend well into the banks and act as buttresses to the side walls and are tied to each other by a 4 x 6 in. concrete beam reinforced with two ⅜ in. rods. The floor, walls, piers and footwalk are reinforced with 26 in. hog wire netting. The structure represents a very good type of check gate and requires only 8¼ cu. yds. of concrete. The carrying capacity of the canal is 200 second feet.

Lateral Headgates and Takeout Boxes.

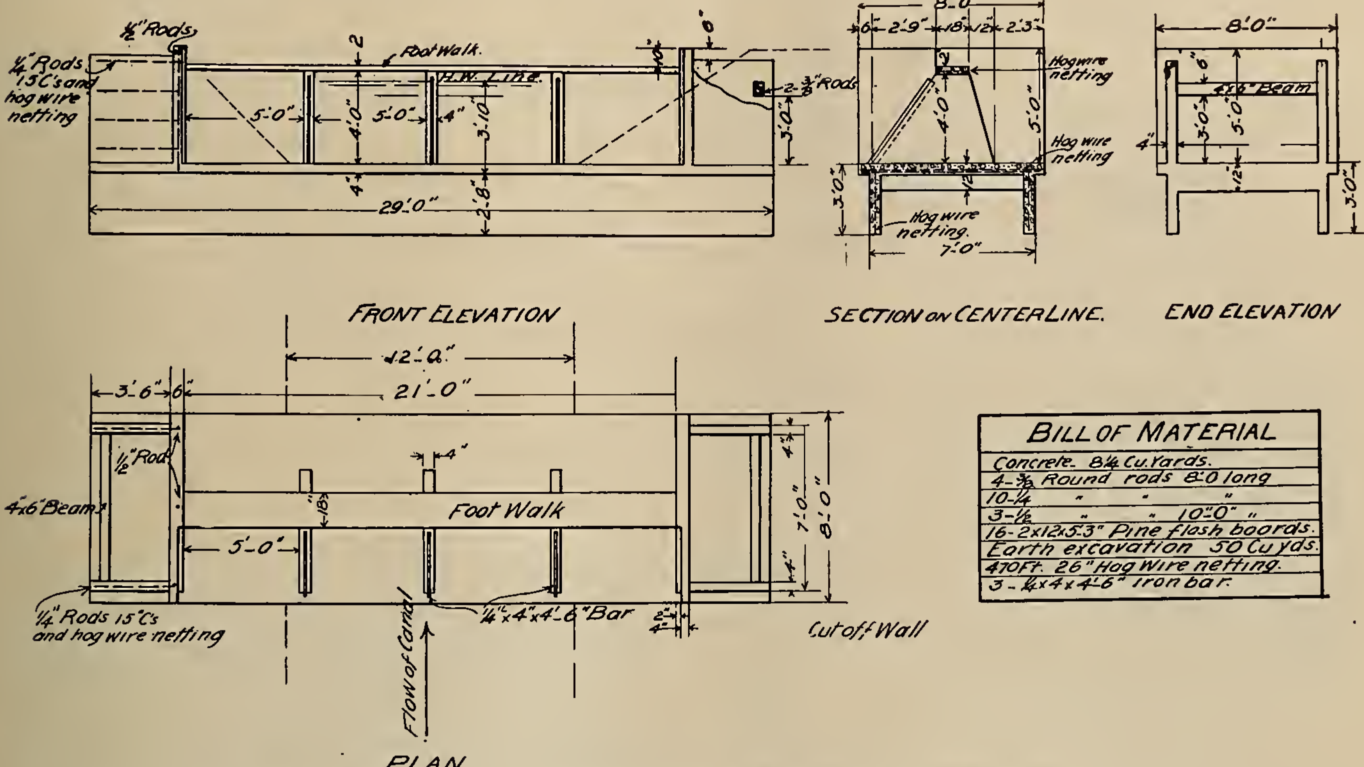
A lateral headgate is necessary at the head of each lateral to regulate the flow in it and at the point of delivery to each farm. On large systems the lateral headgates for the main laterals are frequently of the same type as the headgate of the main canal at the headworks, differing only in size. For the smaller laterals two types are in common use; the culvert type and the open cut type.

The first type consists of a pipe or rectangular box built through the embankment with suitable inlet and outlet. The inlet is regulated with a slide gate and requires a lifting device for the larger sizes. The inlet is generally formed with wings but in some cases consists simply of a concrete protection or collar built around the inlet end of the culvert. The upstream face of the collar may be formed on the same slope as the canal bank and a sloping gate used. The outlet is formed with wings and a floor or may be replaced by a measuring box.

The second type consists of a rectangular chan-

nel or short flume section built in an open cut in the canal bank. The inlet is formed with wings or cut off walls and the outlet is made as the inlet or replaced with a measuring box. The channel may be divided into two or more openings and these are regulated usually with flashboards or simple lift gates. The floor of the takeout box or headgate must be sufficiently low with respect to the bottom of the supply canal to allow the desired volume of water through it when the canal is running partly full. Often the floor of the box is made 6 in. lower than the bottom of the canal.

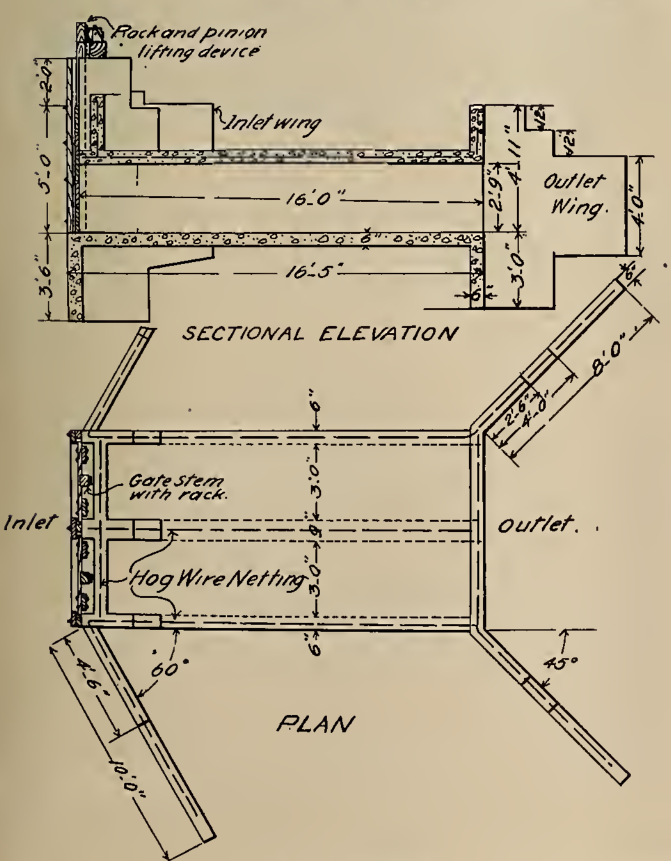
The first type is preferable where the bank of the canal is to be used for a roadway and it is usually more economical for small volumes of water. Examples of the first type are given below.

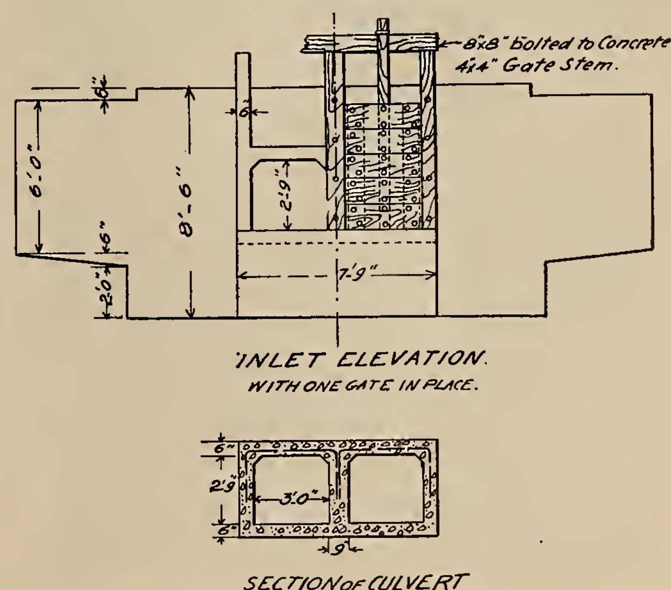


BILL OF MATERIAL
Concrete 8¼ Cu. Yards.
4-⅜ Round rods 8'-0" long
10-¼ " " "
3-½ " " 10'-0" "
16-2x12x5'3" Pine flash boards.
Earth excavation 50 Cu yds.
470 Ft. 26" Hog Wire netting.
3-¼x4x4'-6" iron bar.

Check Gate in Pawnee Canal—Arkansas Valley Sugar Beet and Irrigated Land Company.

The lateral headgate of the Arkansas Valley Sugar Beet & Irrigation Land Company, Colorado, has a capacity of 50 to 100 second feet. It consists of a rectangular box culvert 2 ft. 6 in. high and 4 ft wide, with cut off walls and apron at inlet and outlet and a collar in the center. At the inlet end of the culvert is the regulating gate and operating stand with bevel gear hoisting device. The box is reinforced with two

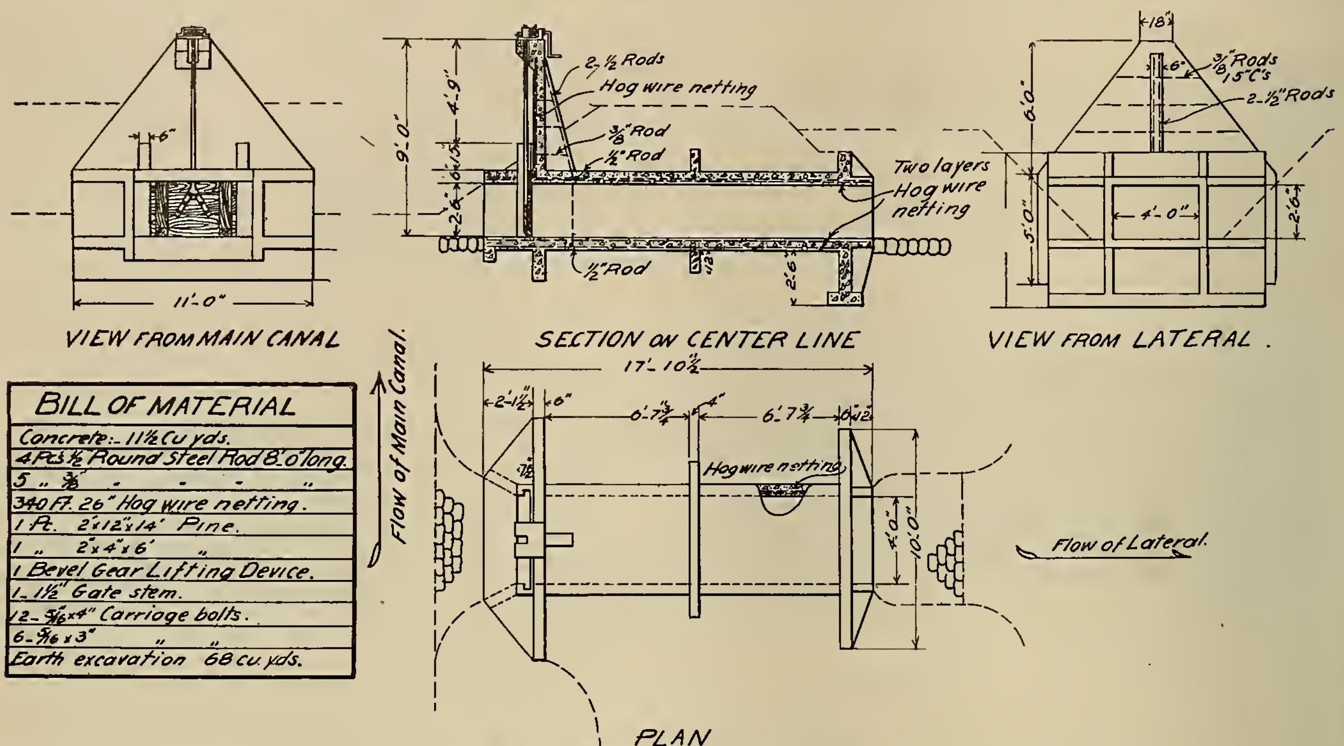




Lateral Headgate for Carlton Lateral—American Beet Sugar Company, Colorado.

layers of hog wire netting. The wall of the operating stand is reinforced with hog wire netting and ⅜ in. rods. The buttress to this wall is reinforced with two ½ in. rods. The structure contains 11.5 cu. yds.

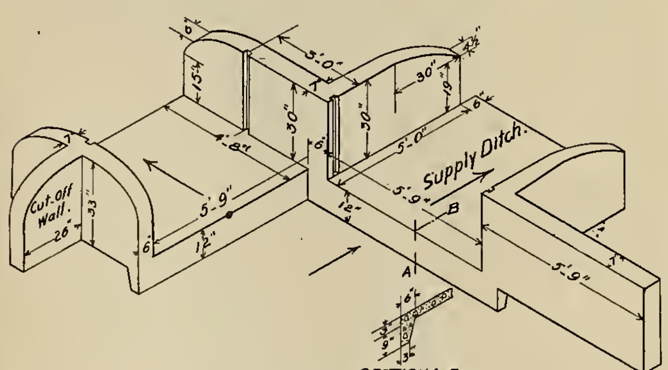
The lateral headgate for the Carlton lateral, American Beet Sugar Company, consists of a rectangular concrete box culvert 16 ft. long with inlet and outlet wings and wooden gates at the inlet. The cross section of the box culvert consists of two openings each, 3 ft. wide by 2 ft. 9 in. long, separated by a center concrete wall 9 in. thick. The floor, roof and sides are all 6 in. thick. The culvert box is reinforced with wire netting placed in the roof and extending part way down the side walls and center wall. The inlet wings are 10 ft. long, 6 in. thick, and reinforced with wire netting. The wings make an angle of 60 degrees with the axis of the culvert and extend 3½ ft. below the grade of the canal which prevents undermining. The outlet wings are 8 ft. long, 6 in. thick, and reinforced with wire netting. The wings make an angle of 45 degrees with the axis of the culvert and extend 3 ft. below grade. At the gate end the side and center wall of the box culvert are stopped up and act as buttresses to the front wall and also support the lifting device. The gate frame is made of lumber and securely bolted to the concrete. The itemized cost is given below. The concrete was a mixture of about 1 part of cement to 6 of gravel. The structure contains about 15 cu. yds. of concrete. Cement cost about $1.45 a barrel. The average cost of the concrete in place is about $10.50 a cu. yd.



Lateral Headgate in Pawnee Canal.

Cost of Lateral Headgate on Carlton Lateral:

	Concrete. 15 cu. yds.	
Labor:		
Excavating, men and teams	$13.60	
Carpenter work on forms	13.00	
Screening gravel	8.23	
Hauling gravel, men and teams	21.30	
Mixing and placing concrete	19.50	
Blacksmith, making bolts	1.00	
Miscellaneous	13.35	$89.88
Material:		
67 bags of cement	$24.58	
Lumber at half value	6.25	
Nails	.45	
Bolts	.89	
Wire netting	1.63	
Cement for plastering and patching	.15	33.95
Engineering:		33.59
Total		$157.42



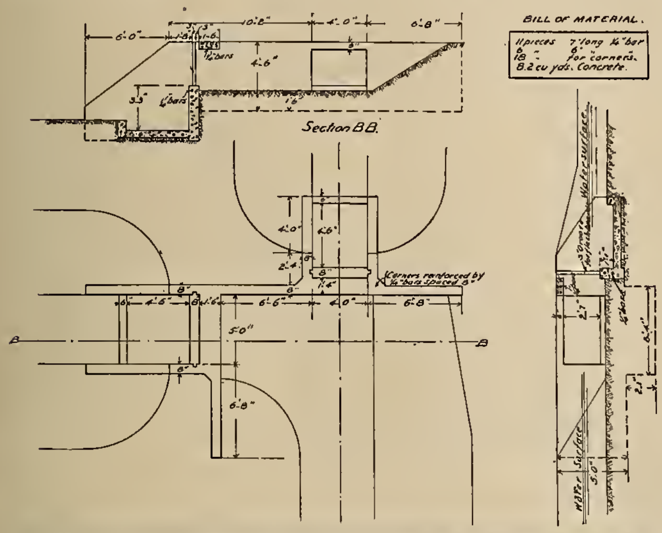
Division and Check Box—Turlock Irrigating District.

Division Boxes.

Division boxes or gates are used where it is necessary to divide the water between two or more ditches. While there is usually only one lateral headgate for each form, there are generally several division boxes. The division box is placed at the junction of two or more ditches. Where there are only two ditches, which is the usual case, two sets of gates are required; one to check and regulate the flow into one ditch and another to control the flow in the second ditch. Simple types of division boxes are the division box used on a farm in the Turlock Irrigation District and the division box on the Umatilla project which combines a turnout and drop.

The division box on a farm in the Turlock Irrigation District was built by the irrigator. It consists of two openings at right angles to each other, formed

with side walls and floors in between. The supply ditch runs in the direction indicated by the arrow and the branch runs at right angles. On the upstream side of the floor a cut off wall or apron extends 12 in. below grade. To prevent washing around the structure a wing wall 5 ft. 9 in. long extends into one ditch bank and a cut off wall 26 in. long is built in the other ditch bank. The flow of water is controlled by flashboards placed in the grooves of the side walls. The



Lateral Turnout and Drop or Division Box—Umatilla Project, Oregon.

box is made of plain concrete but could have been made stronger by placing some reinforcement at the corners. The concrete used consisted of 1 part of cement to about 6 of sand. The forms were made in sections hinged at the corners and have been used for making several of these boxes. About 2 cu. yds. of concrete are required for one box. The sand was very close at hand. The structure in place was built for about $10 exclusive of the forms.

The division box or turn out on Umatilla project is a combined turnout and drop box and is used to regulate and divide the flow between two laterals which have a maximum carrying capacity of 20 to 30 cu. ft. per second. The structure consists of two openings formed between side walls controlled with flashboards inserted in the grooves of the walls and operated from the footwalks. The retaining wall of the drop and the two footwalks are reinforced with ¼ in. bars; the remainder of the structure is made of plain concrete. The total amount of concrete required was 8.2 cu. yds. While the cost of this structure was not obtainable, the itemized unit cost of 83 similar small concrete structures aggregating 93 cu. yds. was as follows:

	Unit cost per cu. yd.
Hauling material (including cost of gravel)....	$7.53
Mixing and placing concrete	5.98
Making forms	4.52
Matelial: Lumber $2.69, cement $2.39	5.08
Total	$23.11

The concrete was composed of 1 part cement to 3 of sand and 4 of gravel. The unit cost is very high and under more favorable conditions should be less than half the cost given.

CLASSIFICATION OF EXHIBITS FOR DEPARTMENT OF LIBERAL ARTS, PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

The following groups show the classification which will be given exhibits for the Department of Liberal Arts at the Panama-Pacific International Exposition in 1915:

Typography—Various Printing Processes, (the equipment, processes and products), including engraving, lithography, typesetting and distributing, typewriting, dictating and addressing machines, mimeographs, etc.

Books and Publications—Book Binding, (the equipment and products), including newspaper and magazine offices or plants, methods of advertising, special libraries, musical scores, etc.

Maps and Apparatus for Geography, Cosmography, Topography—including globes, nautical almanachs for astronomers, surveyors, etc.

Manufacture of Paper, (the raw materials, equipment, processes and products).

Photography, (the equipment, processes and products),—commercial and pictorial, including stereopticons, moving pictures, etc.

Instruments of Precision, Philosophical Apparatus, Coins and Medals, (the equipment, processes and products),—including telescopes, surveyors' and navigators' equipment, optical goods, calculating machines, cash registers, scales, weights and measures, etc.

Medicine and Surgery,—including anatomical models, dental, druggists' and veterinary equipment, X-ray apparatus, artificial eyes and limbs, hospital equipment, etc.

Theatrical Appliances and Equipment,—including arrangements for preventing and extinguishing fires.

Electrical Methods of Communication—including telegraphy, telephony, fire alarms, police signals, etc.

Civil and Military Engineering,—including lighthouse equipment, harbor safeguards, military defenses, water works, sanitation, production of artificial stone, methods of testing materials, etc.

Models, Plans and Designs for Public Works,—including construction, etc., of roads and streets, inland navigation, bridges, subways, tunnels, etc.

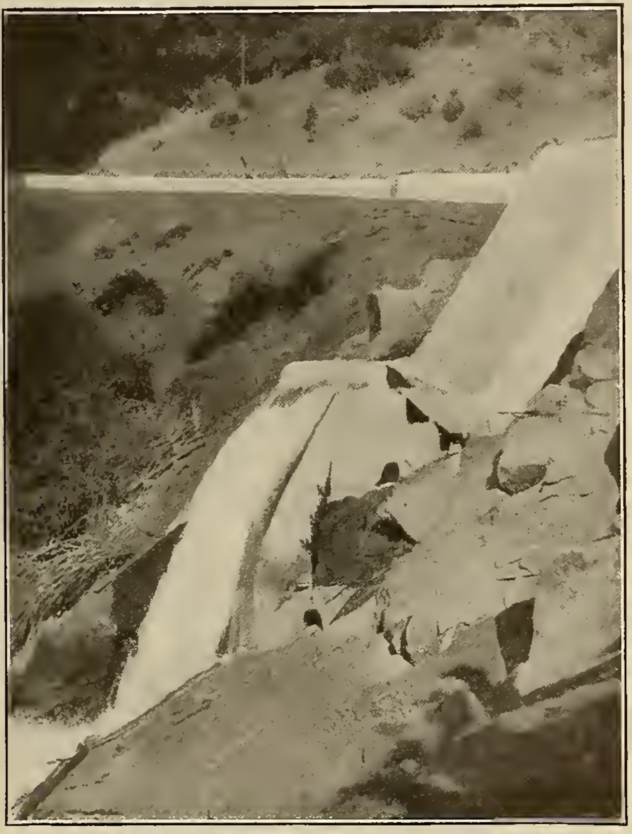
Architecture,—Including mosaics and decorative details, etc.

Architectural Engineering—including safety devices, etc., in passenger elevators, fire escapes, ventilators, etc.

SIPHON SPILLWAYS.

BY C. F. ADAMS.

The use of concrete for flumes has modified other plant details such as head gates, spillways, etc., and has led to the partial adoption of the siphon type of spillway. The relative value of the spillway as a plant feature is largely determined by other plant characteristics. The nature of the load, whether constant or fluctuating; the use or absence of a terminal reservoir; the type of nozzle employed, whether deflecting or rigid with needle valve control; these are all factors that affect the spillway requirements. Where the flume line or ditch crosses and receives water from small canyons, such points must have provision for wasting water during storm periods and disposing of drift materials. Where soil and rock formation above the ditch line are subject to slippage, provision should exist for protection from such accident.

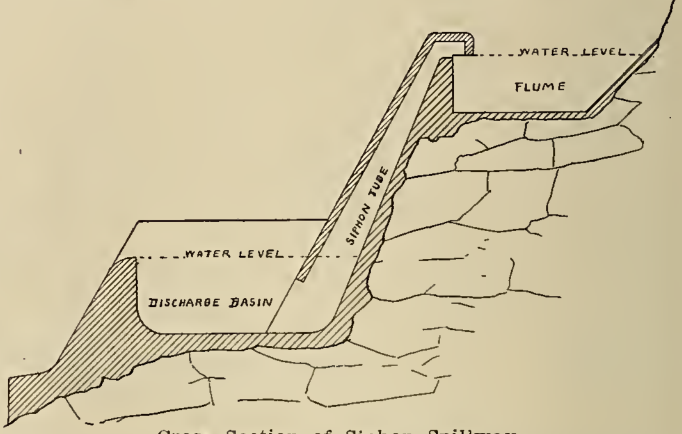


Concrete Siphon Spillway Mt. Whitney Power & Electric Company.

For a plant of small capacity, provided with terminal reservoirs and deflecting nozzles, the spillway problem is simple as the spillway is seldom in use. For the larger installation, where the water conveyed amounts to more than one hundred cu. ft. per second and the flume discharges into the pipe line without a regulating reservoir, then the spillway becomes a vital and essential feature of the plant.

The average operating head found in Pacific Coast plants is about eight hundred feet and the complete discharge of a full flume down the steep mountain side requires a carefull selection of spillway location if excessive erosion is to be avoided. Where an open spillway might require a discharge length of one hundred feet with an overflow of four inches, a siphon will concentrate this discharge into one-tenth this space. With this reduction of spillway space, the flume may be discharged over any convenient rocky point that offers the condition of minimum erosion.

A properly designed siphon tube is similar in its proportions to a turbine draft tube. The tube is slightly conical in form, expanding toward its base, and the velocity of the discharge water is low whatever the height of the tube. The discharge outlet must terminate in a receiving basin that will submerge the lower end of the tube to a depth required to preserve the



Cross Section of Siphon Spillway.

vacuum. This water seal in depth, should approximate eight per cent of the vertical drop of the tube. The maximum possible inlet velocity of the water is that due to an air pressure of 14.7 lbs. per sq. in., which would produce a water velocity of forty-three feet per second. This condition would be approached in a siphon in which the water level in the discharge basin was thirty feet below the water level in the flume during siphon operation. In practice the velocity is limited by the form and area of the entry opening and also by the friction of the tube walls. For safe capacity design, a maximum entry velocity of thirty feet per second may be assumed for tubes thirty feet in height.

The curve of water velocities under different heads also indicates the theoretical inlet velocity of water with siphon tubes up to thirty feet in height. This curve indicates clearly that the most efficient height of siphon tube is much less than thirty feet and good working results are obtained with a height of twelve to sixteen feet. For small flumes or for flood water relief siphons, a height of but six feet gives excellent service.

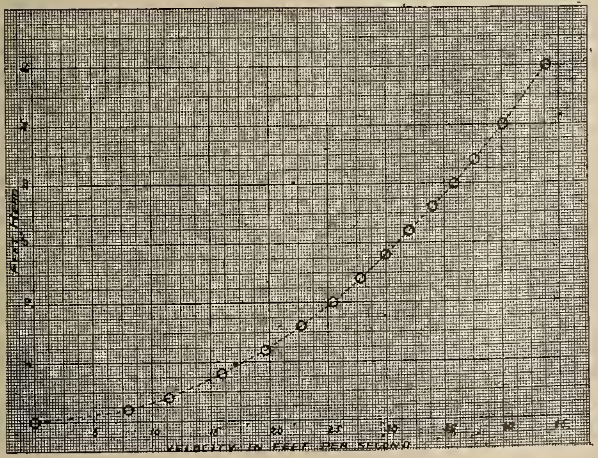
For easy construction and the economical use of materials, a siphon of large capacity should be built in sections, using a number of oblong tubes whose width should not exceed five feet. These tubes would be separated by vertical partitions that will support the strains due to air pressure. The tubes should be given a smooth cement finish in order to reduce friction and also to close any porous surface that might admit air. The entire siphon structure should be mounted on solid rock foundation and should have a solid rock spillway. In the absence of such conditions, a protective footing of solid concrete masonry must be laid to prevent the discharged water from undermining the entire struc-

ture. The entire construction must remain solid and permanently free from cracks and for this reason reinforcing materials should be liberally used.

The removal of wood forms from the siphon tubes is best accomplished by filling the forms only to the water entrance level with the reinforcement in place. When this concrete is firm remove the tube forms, finish the tube wall and then pour the upper section.

To be entirely dependable, the operation of the siphon must be independent of any mechanical operating device. When the flume water reaches a certain level, the siphon must act and remain in operation until the water is lowered to the required level. To obtain rapid and certain action from a siphon, a certain amount of "charging" water must be allowed to flow to fill the lower basin, seal the discharge outlet and then exhaust the air from the siphon tube. The depth of this stream determines the time required for full operation of the siphon. This charging stream for average operation, should have a cross section equal to one-fifth the area of the entry opening, and in the design shown this stream would be two inches in depth.

The question is often asked, "How can a small stream of water flowing down a smooth inclined tube, remove enough air to produce an operating vacuum?" Observation of the action of the siphon indicates that the air becomes engaged by the falling stream, particularly at the base of the stream, and is driven out beneath the lower lip of the siphon, appearing in streams of bubbles that rise out of the discharge basin. The discharge of air increases with the increase of stream flow and several minutes may elapse before the final vacuum and the maximum flow of siphon is reached. The larger the tube, the slower the complete action. The siphon will continue in action until the water level of the flume falls below the entry lip and admits enough air to relieve the vacuum in the tube. There



Curve of Water Velocity Under Pressure.

is considerable surface agitation of the flume water at this time, the siphon taking in water in huge gasps, making and breaking the discharge which finally ceases when the flume water level is about an inch below the entry lip.

Owing to the relatively small opening of the inlet, it should be protected against the lodgement of drift wood by some form of screen. When constructed in localities that are subject to freezing, the discharge basin should have a substantial drain. The dam which closes the front of the discharge basin should conform to standard profiles, with a smooth rollway and an apron extension at the foot. The crest of dam should be wider than the ordinary design on account of the velocity of the discharge water. The receiving basin should have a length at least four times the depth of the siphon tube at its base. These provisions will insure relatively still water in the basin which is essential to the best operation of the siphon.

The discharging siphon shown in the illustration is the first of this type to be installed on the Pacific Coast and its performance has justified its owners, the Mt. Whitney Power & Electric Company in the construction of this interesting type of spillway.

EXPANSION IN ELECTRICAL INDUSTRY IN GERMANY.

The demands caused by the ever increasing use of electricity in almost all walks of industrial life have served to keep the German manufacturers of electrical products unusually busy. In comparison with the prosperity throughout all branches of the German electrical industry during the two previous years, the conditions during 1912 were even more favorable. The improvements made in the generation of electricity and in the means for its transmission by which the current can be furnished to consumers at lower rates have tended to increase greatly the number of overland central stations that have been erected during the past few years for supplying cities, towns, communities, and individual land owners with electric current for light and power purposes.

The German manufacturers during the year received large orders for electric cooking and heating apparatus, for heavy electrical machines, transformers up to 15,000 kilowatts, with a tension up to 110,000 volts, railway signal and safety apparatus, high tension cables, turbines, apparatus for the electrochemical industry, especially for the extraction of nitrogen from the air, and for the ozonation of the water supplies of cities, electric welding apparatus, generators for coupling to gas and Diesel motors, up to 6000 horsepower, electric equipment for submersibles, electromedicinal apparatus, electric cables, insulating materials, etc.

PRICES FOR ELECTRICAL GOODS IN GERMANY.

The prices obtained for German electrical material in 1912, with the exception of those for turbines and metal filament lamps, were on the whole more favorable than during the previous year, but notwithstanding the improvements in the processes of manufacture they could not be kept on a parity with the increased costs of production. The financial results for 1912 were good, as evidenced by the fact that almost all the German electrical companies were able either to increase their dividends or to maintain those declared during the previous year. To meet the ever-growing demands of the electrical industry both of the larger companies were compelled to raise their own capital stocks and in some instances those of their subsidiary concerns.

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POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1890.
Entry changed May 1. 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Federal Water Power Policy

Secretary Franklin K. Lane of the Department of the Interior is showing a more conciliatory attitude toward the hydroelectric power companies than did some of his predecessors. Last week he made preliminary announcement of the administration's policy as to the disposition of the government's water rights. While the requirements are still too rigid to attract capital from the ordinary investor, yet it is the spirit more than the letter of the announcement that raises the hope that this question will soon be settled to the satisfaction of both the public and the power company.

After considering a power project on the Pend O'Reille river in Northern Washington, the Secretary has laid down five conditions as "an ideal standard toward which to work in the making of the contract between the government and the applicants for the use of power." These conditions are:

1. The greater the development of horsepower, the lower charge per horsepower to be made on the part of the Government. This is intended to secure the full use of the stream.

2. The lower the rate to consumers the lower the charge on the part of the Government.

3. No charge whatever for a period of five or ten years during which the power company is finding its market.

4. Acceptance as a public utility of the State's jurisdiction over intrastate rates and service and of Federal jurisdiction over interstate rates and service.

5. Absolute prohibition of combination or monopoly and the right of revocation on the part of the Government in the event that it is established to the satisfaction of the Secretary of the Interior or the courts that such combination has been made or that prices have been fixed by agreement with competing plants.

The third condition, particularly, is one toward which engineers have been working for some years and if incorporated in the law will greatly encourage development. It must be remembered that these conditions are not yet law, merely being suggestive of the Department's attitude in interpreting existing law. Consequently criticism from us with regards to the indefiniteness of the several provisions is not now in order. It is merely a straw to show the wind's direction.

Another Transmission Record

The change of fashion in the design of electric power systems should be of particular interest to all engineers. Even those who most strenuously advocate standardization of all construction, with its resulting economy, must admit that change signifies progress. Every unique piece of construction should be studied so that its good points may be used to increase the efficiency of future plants. When all engineering work is so standardized that no improvement can be made, the industry will stagnate. Fortunately so many new situations requiring special design are so frequently arising that new styles must constantly be created to take care of them.

With these thoughts in mind much profit will follow a close study of the description of the system of the Southern Sierras Power Company published in the first two issues of this volume. The first deals with generation, the second with transmission and distribution. Yet another could be written on the commer-

cial utilization of this power by distant mines and irrigation plants—but that is another story.

As regards the power development, every endeavor has been made to fully utilize the limited amount of water available on the precipitous eastern scarp of the Sierra Nevada Mountains which rob the moisture from the highest clouds. Five plants are already pulling in tandem along the short course of Bishop Creek where a mile drop in elevation makes every drop of water count. The ultimate installation of two more plants and the complete development of storage capabilities will make this one of the world's most intensive utilizations of the power of falling water. The most noticeable feature in construction is the absence of open canal, ditch or tunnel. Gravity flow or pressure pipe not only conserves the water and keeps out snow and ice but also gives the benefit of regulation from the intake reservoirs. Few automatic regulating devices are necessary because of the constant water flow.

But the spectacular feature of the system is the transmission line. Two hundred and thirty-eight miles of uninterrupted transmission at one hundred and forty thousand volts sets a new record in commercial long-distance, high-tension practice. Steel-aluminum conductor is used throughout, special tower designs have been employed and out-door transformer stations are utilized. The data which the author has compiled on these several subjects is here published for the first time and should form a valuable reference for all contemplating similar installations.

Much of the material was "made to order" for this installation. Engineers may criticize this practice unless they consider the unique conditions which were to be met. The courage and common sense of a pioneer guides him in departing from the beaten path of precedent. While the special standards of this system could not be adopted as standard specifications for national use, they are peculiarly well suited for this particular system. All honor and credit should be given to the ability of the engineer who can determine when "circumstances alter cases" and devise new and better methods to meet such circumstances.

Blue Sky Legislation

A smokeless city, like a noiseless Fourth of July, is a matter of education. Persistent effort has finally forced many towns to prohibit fireworks. The record of the past week shows that as a result there have been fewer fires and deaths than ever before. While smoking chimneys have not exacted the same terrible death toll as exploding firecrackers, their cumulative damage to surrounding property and the involved fuel waste causes a much greater annual loss than may be ascribed to the celebration of the festive Fourth. Consequently anti-smoke ordinances are being enforced in many cities of the country.

No small part of the ninety per cent waste in fuel use is due to unnecessary smoke. By preventing even a small part of this loss we will benefit ourselves as well as our posterity, who will blame us more for our wasteful use of power than they will praise us for our conserving disuse. Scientific management of the power plant must begin with the improvement of fuel combustion.

Proper combustion means proper air supply. Hydrocarbons are volatile at temperatures far below their ignition point and without sufficient air they are liable to pass up the chimney unconsumed, or at least only partially combined as carbon monoxide, whose formation liberates less than one-third as much heat as does that of carbon dioxide. Furthermore, if the flame strikes the comparatively cold boiler tubes before its burden of hydrocarbon vapor is consumed, it is extinguished as it would be by the wire gauze of a miner's safety lamp. Passing on as dense black smoke it poisons the air and pollutes all that it touches. By enlarging the combustion chamber so as to interpose more space between the grate and the boiler the gases are burned before cooled and the smoke is minimized.

Too much air is almost as bad as too little as it carries up the stack the heat which would otherwise be imparted to the water. The evil effects of excess air are usually under-estimated. If the plant owner had to pay for his air as he does for his water he would caution the fireman to use less. But as the air costs nothing he continues blissfully ignorant that this free agent is regularly robbing the heat produced by at least one in every eight barrels of oil. Study of his fuel bill will show that there is nothing so expensive as what he gets for nothing.

A certain amount of smoke from a power plant is as unavoidable as fleas on a dog, especially with fluctuating load. Yet it is easy to calculate the correct amount of air to burn a fuel of known composition. Good practice allows an excess of fifty per cent over this theoretical amount. Many plants, however, are using an excess of two hundred per cent, or more. Reducing this spells fuel economy.

The amount of air being used may either be directly measured with an anenometer, the heat loss may be determined by a pyrometer or the air content be ascertained by an analysis of the flue gas, the last method being in most general use. The percentage of carbon dioxide is also a reliable index of the amount of air passing through the furnace. When the correct percentage has once been determined by an expert the fireman merely has to maintain it by adjusting his damper in accordance with the reading of some one of the mechanical carbon dioxide indicators that are on the market.

Smoke is not only an industrial waste but is also a legal nuisance. Any reasonable "blue sky" ordinance intended for its abatement will be sustained by the courts. When the dirt that it creates and the discomfort that it causes become intolerable, the sufferers are compelled to appeal to the lawyer for relief and drastic legislation frequently ensues. This may be obviated by a little care and foresight on the part of the stationary engineer if he will but anticipate this inevitable effort for civic betterment by drafting aud urging more reasonable laws.

The engineer should not leave to the lawyer and politician the regulation and even the operation of his plant.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

R. Wiley, superintendent of an electric power plant near Mexico City, is in San Francisco.

L. R. Boynton of the Central Electric Company, Los Angeles, was in San Francisco this week.

R. D. Holabird of Holabird Reynolds Company, San Francisco, is spending a vacation at Lake Tahoe, California.

C. W. Chalfant of the Los Angeles branch of the Pacific States Electric Company, was a visitor to San Francisco last week.

R. W. Turnbull, connected with the General Electric Company at Seattle is spending a few days in San Francisco.

C. F. Conn, electrical engineer of J. G. White & Company, has just returned from a business trip throughout the East.

C. L. Wernicke, Portland representative of the Westinghouse Electric & Manufacturing Company, spent a day in Seattle recently.

F. B. Uhrig, district manager of the Western Electric Company, Kansas City, arrived in San Francisco the latter part of the week.

F. N. Kollock Jr., district manager Westinghouse Electric & Manufacturing Company, Seattle, was in Portland some days ago on business.

A. L. Kempster, general superintendent of the Puget Sound Traction, Light & Power Company, has recently been made manager of the company.

L. Levy of the Levy Electric Company, San Francisco, is among those who have caught the vacation habit and is resting up at Lake Tahoe, Cal.

G. B. Harrington, assistant general superintendent of the Puget Sound Traction, Light & Power Company, has been made first assistant to the manager.

A. B. Martin, formerly employed on electrical work in Vancouver, B. C., has joined the sales force of the Pacific States Electric Company at Seattle.

J. F. NePage, of NePage, McKenny & Company, electrical engineers and contractors, Seattle, spent several days last week on a business trip to Portland.

J. P. Lottrige from the Portland office of the General Electric Company, was in Seattle last week making transfer of the company's stock from the warehouse of the Western Electric Company to 610 Railroad avenue

Thos. Collins of the sales department Westinghouse Electric & Manufacturing Company, San Francisco, has been confined to a sick bed several days. Physicians in attendance have prescribed a complete rest from business cares.

W. S. Hanbridge, secretary of the Electrical Contractors' Association, San Francisco, left Thursday for Chattanooga, Tenn., as delegate of the California Electrical Contractors' Association to the National Contractors' Convention, which meets in that city July 15th.

M. T. Crawford, superintendent of transmission Puget Sound Traction, Light & Power Company, has returned from the A. I. E. E. convention held at Cooperstown, N. Y. He also made a rather extended trip in viewing many of the transmission projects throughout the east.

W. P. Neville, who has been the freight and passenger agent for the Central California Traction Company in Sacramento for the last two years, has been appointed to the position of general agent. Neville will be in charge of the freight and passenger business for the entire line.

T. E. Bibbins, assistant general manager of the General Electric Company, San Francisco, has returned from an extended trip through the East during the course of which he attended the National Electric Light Association Convention at Chicago, and visited the Schenectady plant of the company.

F. S. Pratt, vice-president of the Stone & Webster Company, and **W. E. Herring**, industrial agent of the Puget Sound Traction, Light & Power Company, recently returned from an inspection trip extending as far north as the international boundary. Mr. Pratt departed for Boston July 8th.

G. B. Fairbanks, formerly salesman with the Westinghouse Manufacturing Company, Seattle, and assistant manager Chicago office, Fort Wayne Works of the General Electric Company, has joined forces with Colman & Hahn Electric Company, electrical contractors, at 1123 South A street, Tacoma.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Santa Barbara Gas & Electric Company has applied for authority to issue $100,000 in bonds for the purpose of extending and improving its system.

The San Joaquin Light & Power Company has filed an application for authority to issue $2,500,000 bonds, and to use them as collateral security for the issuance of $1,875,000 of two-year collateral trust notes. It is proposed to use the proceeds in making additions to the company's facilities.

Postponement until July 21 was made of the hearing of the application of the Oro Electric Corporation and the Oro Development Company to dispose of 1000 first mortgage 6 per cent gold bonds of a par value of $1000 each.

The commission has granted authority to the San Diego Consolidated Gas & Electric Company to issue $639,000 of its 5 per cent 30-year bonds. The money is to be used for the purpose of building plant additions.

The Great Western Power Company has been granted authority to operate under franchises previously given in Contra Costa county, particularly in the vicinity of Antioch.

Application of the Honey Lake Valley Mutual Telephone Association to issue promissory notes in the sum of $10,000 has been granted.

The Beaumont Gas & Power Company has been granted authority to issue a mortgage note in the sum of $5000 for the purpose of paying off existing indebtedness.

The application of W. L. Childers to lease the Crescent City Water Works to the Mountain Power Company, of Crescent City, Del Norte county, has been granted. The Mountain Power Company also takes an option to purchase.

Authority was granted to the Southern California Edison Company to issue 30,000 shares of its common capital stock of the par value of $100 per share. The company will offer 1000 shares to its own stockholders and a syndicate is being formed to underwrite the remaining 20,000 shares. The order of the commission provides that the stock shall be sold for not less than $80 per share. This is one of the largest issues of stock which the commission has authorized, and in making the authorization the commission states that it approves of this policy of selling stock to raise a portion of the money needed for capital expenditures. The commission approves the plan under which 75 per cent of the money for additions and betterments is to be raised from bonds and the remaining 25 per cent from stock.

TRADE NOTES.

Brayton Engineering Company, Portland, have received the contract for the Pittock Block. D. E. Lee will superintend the electrical installation.

The Gambrinus Brewing Company, Portland, have installed a 100 kilowatt, 220 volt, 3-phase General Electric generator direct connected to a Ball compound engine.

An order for over five thousand No. 6541 receptacles and plates has been placed with the Manhattan Electrical Supply Company for installation in the new municipal building in in New York City.

Buxbaum & Cooley, electrical engineers and contractors, Seattle, have the contract for installing a 7 kw. and a 2 kw. turbine generator set in the new Lake Washington ferry for lighting purposes.

The A. Z. Smith Electric Company, Tacoma, has completed the installation of a 90 foot span 350 foot timber crane and 5-ton hoist for the Pacific States Lumber Company at Sellick, Washington.

The Gas Consumers Supply Company, Tacoma, has secured contracts for equipping all of the kitchens in the Mottau apartments as well as the Wheeler apartments with Detroit Jewel cabinet gas ranges.

David Dow & Son, Seattle, recently installed for the Manhattan Construction Company all the electrical machinery for driving the mixers, hoists and saws being used in the construction of the Bryant and Concord school buildings.

Fairbanks, Morse & Company are furnishing the electrical equipment for a large refrigerating plant for the Rogue River Fruit Produce Association at Medford, Ore. One 50 horsepower motor, one 15 horsepower motor and two 40 kw. transformers will be installed.

The Greenwood Advertising Agency (Western) of Los Angeles, Cal., recently shipped a large electric sign to the Puget Sound Traction, Light & Power Company of Seattle. The sign filled an entire car. It is 200 ft. long and 56 ft. in height and is to be installed on their power plant at Dieringer, Wash.

The Reynolds Electric Company, Seattle, has sold a 2-ton electric hoist to the Alaska Steamship Company, same to be installed at Ketchikan, Alaska. A 50 h.p. motor and hoisting rigs were sold to the Ferro Concrete Construction Company to be shipped to Vancouver, B. C. A 17½ kw. lighting plant is also being installed for the Nipon Lumber Company at Nipon, Washington.

NEW CATALOGUES.

The Sprague Electric Works of General Electric Company has issued Catalog No. 521 describing Flexible Steel-Armored Hose for railroad service.

The William B. Pollock Company, Youngstown, Ohio, has issued an attractive folder illustrating the use of their steel penstocks in the Keokuk Development.

The Standard Underground Cable Company, Pittsburg, has issued Bulletin No. 700-1 giving descriptions of their "Outdoor Cable Terminals." A comprehensive index is appended.

"Electricity in the Manufacture of Jewelry," issued as Circular No. 3071 by the Holtzer-Cabot Electric Co., Boston and Chicago, describes many kinds of electric drive suitable for manufacturing jewelers. The booklet contains a variety of cuts illustrating the application of these devices.

A new publication on "Outdoor Cable Terminals" known as Bulletin No. 700-1 has been received from the Standard Underground Cable Company, Pittsburgh, Pa. This volume is 6 x 9 in. in size and contains 28 pages of condensed descriptive matter, illustrations and tables of dimensions, voltages, weights, etc., together with instructions for ordering and installing outdoor cable terminals. This bulletin is the first of a forthcoming series which is designed to supply its customers and prospective customers with such information as can be conveniently filed for reference. Copies will be sent to those interested upon request.

As a means of creating a desire for electric appliances, "The Silk Cord," published by Electric Development Association, Inc., of Boston, must surely be a success. The June issue especially is cleverly gotten up. Central stations contemplating publishing similar organs will do well to take a look at this example of a creator of desires.

The June issue of Edison Current Topics, published by the Southern California Edison Company, is one of the most truly electrical station organs published. The front cover, designed by Charles H. Pierson, depicts the spirit of light shedding her bounteous gift over Los Angeles, while the back cover shows the rugged mountains from which the source springs. Contributions by John B. Miller, Alan E. Morphy and S. M. Kennedy, together with many smaller personal items make this publication interesting to employes and consumers among whom it is circulated.

As a companion book to "Catechism on Direct Current Apparatus," Fairbanks, Morse & Co., of Chicago, have recently issued a Catechism on Alternating Current Apparatus. The booklet deals with the construction and application of generators, motors and auxiliary equipment in which the writer has succeeded in giving in a condensed question and answer form a great amount of practical information. A glossary covering all electrical terms used is included, which makes the book of considerable value to the non-technical man. Copies will be sent to interested parties on request to the Chicago office of the company.

BOOK REVIEWS.

Water-Supply Paper 314. Surface Water Supply of Seward Peninsula, Alaska. By F. F. Henshaw and G. L. Parker; with a sketch of the geography and geology by P. S. Smith and a description of methods of placer mining by A. H. Brooks. 1913. 317 pages; 17 plates; 12 text figures.

Presents in detail the results of stream-flow measurements made in Seward Peninsula during the years 1906 to 1910, inclusive. The geography and geology of the peninsula are first briefly described, inasmuch as they have a controlling influence on the run-off, and the occurrence and distribution of the gold placers are summarized in the section devoted to geology. At present the mining of the placer gold is the only incentive to the utilization of the stream-flow. Methods and costs of mining are also briefly considered. The illustrations include topographic and geologic maps of Seward Peninsula and plates showing methods of hydraulic mining.

Resuscitation. By Dr. Chas. A. Lauffer, Medical Director, Westinghouse Electric and Manufacturing Company. Size, 4¼ x 6½ inches; 7 illustrations; cloth binding. Published by John Wiley & Sons, and for sale by Technical Publishing Company, Rialto Bldg., San Francisco. Price, 50 cents.

This book includes a reprint of a paper on this subject delivered by the author before the Philadelphia Section of the National Electric Light Association. The author, after explaining a number of successful results which have been obtained from employing resuscitation methods on men who were supposedly dead, gives a clear description of the mechanism of respiration, illustrating same by a number of views of the various parts of the anatomy.

This book brings out in a clear, concise manner the necessity of people in general being versed in the principles of resuscitation, and clearly shows how they can be taught so as to prove of valuable assistance to persons in the ordinary walks of life.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

NEW ELECTRICAL ORDINANCE.

The following ordinance affecting Electrical Contractors has been passed by the Board of Supervisors of San Francisco:

AN ORDINANCE REGULATING THE INSTALLATION, CONSTRUCTION, OPERATION AND INSPECTING OF ELECTRICAL WIRES, APPLIANCES AND APPARATUS, IN OR ABOUT BUILDINGS OR OTHER STRUCTURES IN THE CITY AND COUNTY OF SAN FRANCISCO, FIXING A STANDARD THEREFOR, PROVIDING FOR THE GRANTING OF PERMITS TO MASTER ELECTRICIANS AND FOR THE REVOCATION THEREOF; AND PROVIDING FOR THE CONDEMNATION OF ELECTRICAL WORK OR INSTALLATION OF APPARATUS NOT IN CONFORMITY HEREWITH AND FORBIDDING THE FURNISHING OF ELECTRICAL CURRENT TO SAID CONDEMNED ELECTRICAL INSTALLATION AND FIXING PENALTIES THEREFOR, AND REPEALING ALL ORDINANCES IN CONFLICT HEREWITH.

Be it ordained by the People of the City and County of San Francisco as follows:

Section A. Every person, firm or corporation engaged in the business of placing, installing, erecting or contracting to place, install or erect any electrical wires, appliances, apparatus or construction in or on buildings or other structures shall, before commencing or performing any such work pay such license fee as may be prescribed by ordinance and appear in person, or by duly authorized agent, at the office of the Department of Electricity and upon presentation of his said license be entitled to the registration of his or their name and place of business in the said city and county of San Francisco as a Master Electrician, and to a permit from said Department of Electricity to engage in the business of Master Electrician in said city and county; provided, that no such permit shall be granted for a longer period than the date of expiration of aforesaid license.

Sec. B. Every person, firm or corporation shall, before placing, installing or erecting any electrical wires, appliances, apparatus or conductors, or to electrically connect any electrical wires or conductors, together or to any electrical machinery, in or on buildings or other structures, file with the Department of Electricity a written application for a permit to proceed with such work, the aforesaid application for permit shall be accompanied by a brief specification showing the kind and nature of the proposed electrical apparatus, wires, appliances or construction and the location and description of the premises wherein the work is to be performed. Said permit shall be conspicuously posted on the premises wherein said electrical work is being installed. Provided, however, that no such permit to proceed with such work shall be issued by the Department of Electricity to any person, firm, corporation, or individual that has not received a permit to do business as a Master Electrician in conformity with the terms of this ordinance.

Sec. C. It shall be unlawful to conceal or cause to be concealed, any wires, apparatus, appliances or construction in or on any buildings or other structures before same has been inspected by the Chief of the Department of Electricity, or his authorized representative, and his approval posted on the building or other structure wherein same is installed.

Sec. D. Every person, firm or corporation placing, installing, erecting any electrical wires, appliances, apparatus or construction, or electrically connecting any electrical wires or conductors together, or to any electrical machinery, in or on buildings or other structures, shall notify the Chief of the Department of Electricity when same is completed. The Chief of the Department of Electricity or his authorized representative, shall at once inspect the same, and if in compliance with all ordinances, shall issue to the said person, firm or corporation a certificate of approval. Said certificate shall contain the date of final inspection and in concise terms specify the electrical wires, appliances, apparatus or construction thus approved.

Sec. E. The failure, neglect or refusal on the part of any person, firm or corporation, for the period of ten days after receipt of a notification so to do in writing, by the Chief of the Department of Electricity, to correct, obviate or remove any fault, error or deficiency in placing, installing, erecting any electrical wires, appliances, apparatus or construction, or in electrically connecting any electric wires or conductors together or to any electrical machinery, appliances, apparatus or fixtures in or on auy building or structure in the city and county of San Francisco to conform with the provisions of all ordinances of this city and county and in all other respects to conform with the best known general standards existing at such time shall be deemed sufficient cause for the Chief of the Department of Electricity to revoke the offending party's permit to transact the business of Master Electrician until such faults, errors or deficiencies are corrected, as hereinabove set forth.

Sec. F. Any corporation, co-partnership, association or individual, or agent thereof, owning, operating or in the possession of any building or other structure within the limits of the city and county of San Francisco, shall permit the Inspector of the Department of Electricity to enter such or premises as often as shall be deemed necessary by the Chief of the Department of Electricity for the purpose of inspecting the electrical wiring appliances, apparatus, construction or equipment in or about said plant, building or other structure and it shall be unlawful for any occupant or owner of premises where any electrical wires, apparatus, appliances, construction or equipment are used, or any person whatever, to prevent or interfere with any Inspector in the discharge of his duties under this ordinance; provided, however, that the said Inspector shall, upon the request of the owner or occupant of said premises, exhibit his authority to make such inspection, which shall be signed by the Chief of the Department of Electricity. Should the Chief of the Department of Electricity or any inspector thereof find the installation of any electrical wiring apparatus, appliances, construction or equipment to be defective or not in accordance with the provisions of any ordinance or the standards fixed herein, the same shall be condemned and the use threof forbidden until the same be corrected; upon the failure of any corporation, co-partnership, association, individual or agent thereof owning or leasing any building or structure in the city and county of San Francisco to correct such defective and condemned electrical wiring apparatus, appliances, construction or equipment, for a period of six days after the receipt of notice in writing from the Chief of the Department of Electricity so to do, which notice shall specify in detail the connecting to be made, the said Chief of the Department of Electricity shall forthwith direct the corporation, co-partnership, association or individual, or agent thereof, supplying the electrical power for said connection, to disconnect the same, and it shall be unlawful for any corporation, co-partnership, association or individual, or agent thereof, furnishing electrical current, to furnish or renew said power supply without permission from the Chief of the Department of Electricity.

(To be continued.)

INDUSTRIAL

ELECTRIC HALF-TONES.

The accompanying illustrations show a recent development in electric signs which has been perfected by the Greenwood Advertising Agency.

Heretofore the bringing out of features or faces electrically has been unsatisfactory but by this method faces can be brought out in silhouette and by proper manipulation

Electric Half-tone of George Washington.

Two Views of a Changing Half-tone.

of the lights different expressions can be obtained. The idea is the same as cartoonists use for daylight effects, but has never before been aplied to night displays. As a means of bringing into greater prominence convention leaders and political candidates, this novel device will add to the attractiveness of the "Great White Ways" and expositions of the future. The changing face shown here is one that is being erected in Los Angeles.

MANUFACTURING IN A FLOWER GARDEN.

Commuters on the Montclair Branch of the Delaware, Lackawanna & Western Railroad are treated to a very attractive demonstration of the fact that a manufacturing plant need not necessarily be an eyesore and a blot on the landscape. Twice a day, as their trains have passed the station at Ampere, N. J., they have caught a glimpse of a group of neat and orderly factory buildings, set amid twenty-five acres of well kept lawns, flower beds, shrubbery and big shade trees, and all surrounded by a half-mile girdle of pink rambler roses in full bloom.

The attractive appearance of this industrial plant, which is owned and operated by the Crocker-Wheeler Company, manufacturers of electrical machinery, is an interesting commentary on the present attitude of most progressive corporations toward the general public. This particular company evidently regards it as a duty to the community as well as to itself to have its works present a clean orderly aspect, and even an attractive one, so far as this is possible in a manufacturing establishment.

USES OF STORAGE BATTERIES.

The remarkable accomplishments of electricity are too well known to require comment, but many readers do not appreciate the part that has been played by storage batteries in the development and use of electrical apparatus.

This month, the Crocker Land Expedition under the auspices of the American Museum of Natural History, the American Geographical Society, the University of Illinois and other institutions, will sail from New York City to explore the North Polar regions.

One of the interesting features of this expedition's equipment will be a complete electric lighting plant, which will be installed in a portable house at about 80 deg. north latitude. This lighting plant will be equipped with an "Ironclad-Exide" Battery, so that electric lights will be available at all times, and it will only be necessary to run a kerosene engine occasionally to charge the battery. The electrical apparatus of this expedition will be in charge of Ensign Fitzhugh Green, U. S. N.

This battery will be composed of 20 trays weighing 1720 pounds and having sufficient electrical capacity to light 115 eight candlepower lamps for ten hours.

The digging of the Panama Canal, which is to be opened this fall, has been done largely by electrical machinery in connection with which storage batteries have been used. The batteries chosen by United States Government engineers for this service have been of the type known as the "Chloride Accumulator," and even at the high temperatures experienced in this tropical region have given most satisfactory service. These facts demonstrate that storage batteries of the proper types will operate satisfactorily in either very cold or very warm climates. The "Chloride Accumulator" is also used in connection with wireless apparatus and for electric lighting and power service.

The United States Government in its various departments has extensively studied and experimented with storage batteries and utilizes them for numerous purposes. Submarine boats of the navy, when submerged, are propelled through the water by current furnished from storage batteries. War ships use storage batteries for firing large guns and depend upon them for the emergency operation of wireless apparatus. Vessels of the navy as well as fortifications on land are provided with storage batteries as an emergency outfit for furnishing electric lights. In the Postoffice Service and at many navy yards the Government uses electric motor cars propelled by storage batteries.

Storage batteries are constantly finding many new and popular used, such as for starting and lighting automobiles, and, therefore, a little storage battery knowledge is well worth while.

The Electric Storage Battery Company is one with a service organization extending throughout the country, at the disposal of storage battery users, and it is the desire of the company to consult with and help any one who uses storage batteries for any purpose.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—Madera Gas Company; capital stock, $75,000; L. R. Kurtz, P. T. Moses and H. L. Decker, directors.

ILLUMINATION.

NEEDLES, CAL.—The Needles Gas & Electric Company was the only bidder for lighting the town of Needles.

LONG BEACH, CAL.—The city council has adopted specifications for installing and equipping ornamental lighting standards in this city.

MONROVIA, CAL.—Extensive improvements have begun on the plant of the Southern Counties Gas Company. The total cost of machinery, which will be installed by the Baker Iron Works, is estimated at $80,000.

ORANGE, CAL.—The Pacific Light & Power Corporation has been granted a franchise to operate for a period of 50 years for transmitting electric power for lighting, heating and power purposes, in Orange county.

SEATTLE, WASH.—The Puget Sound Traction Light & Power Company has made application to the King county commissioners for three lighting franchises, one in North Seattle, one in Kirkland and the other in Redmond.

BERKELEY, CAL.—At a meeting of the City Council this week the Great Western Power Company made formal request for a 35-year franchise to transact its light and power business in this city. It is reported that the city officials favor the granting of the franchise.

TACOMA, WASH.—The electrically equipped planing mill of the St. Paul and Tacoma Lumber Company is ready for operation. The 1000 kw. turbo-generator to be used in operating the planing mill and furnishing light and power for the plant generally has arrived and will be put in operation shortly.

OAKLAND, CAL.—Geo. E. Babcock, city electrician, after a conference with Fred C. Turner, commissioner of public health and safety, has evolved a plan gradually to install a municipal system of street lighting, by which the city will own the poles, wires, lights and other equipment. The plan provides that the city will put in the street lighting system district by district until the municipal lines extend over the entire city.

SEATTLE, WASH.—The City Council of Seattle has adopted a resolution which has been referred to the Corporation Council, requesting that the State Public Service Commission appraise the property of the Seattle Lighting Company, investigate its rates, its charges for gas and its practices, with a view to rate reduction and adjustment of grievances. The former engineer of the Commission estimated the value of the plant for rate-making purposes at $6,000,000.

SEATTLE, WASH.—The supreme court of Washington recently held that the Puget Sound Traction, Light & Power Company be required to pay an assessment of $3822 for regrading the Harrison street district in Seattle. In the condemnation proceedings to determine damage to property in the district by reason of a regrade, the company was awarded $5000 damages. Ou the ground that the award for damages in the condemnation proceedings released it from the assessment, the company refused to pay.

ANAHEIM, CAL.—Natural gas brought to Los Angeles from Midway is to be supplemented by a supply from the fields in and around La Habra Valley. The Southern California Gas Company has secured 5,000,000 cu. ft. of natural gas, produced daily by the oil wells of the Amalgamated Oil Company, and whatever amount may be added to this by development. The plans call for an 8-inch pipe line to Los Angeles and compressor station in the field to furnish motor power to transmit gas a distance of 20 miles.

VANCOUVER, B. C.—Proposals have been submitted by the British Columbia Gas Company, for the approval of the Vancouver city engineer, for constructing a new gas-generating plant in Hastings Townsite, Vancouver, at an estimated cost of $1,500,000, and covering about seven acres. The first unit will cost $150,000, which it is expected will be ample for five years, after which another $500,000 unit will be constructed, suffiicent for ten years. Subsequently a third $250,-000 unit will be built. Work on the first unit will start as soon as permission is received, and it is thought will be completed within twelve or fifteen months.

TRANSMISSION.

LONG BEACH, CAL.—A building permit has been issued to the Southern California Edison Company for the first unit of its plant to be erected on the west side of the harbor. The unit is to cost $288000, and is to be class A, reinforced concrete construction. Work will begin in 30 days.

VANCOUVER, B. C.—Anticipating the future requirements of Greater Vancouver and the probability of the electrification of the coast section of the Pacific Great Eastern Railway, the Bridge River Company, recently incorporated, plans to develop at least 200,000 horsepower in the Lillocat District. The expenditure involved will be about $3,000,000. The project calls for the building of a large dam on the Bridge River and a tunnel two and one-half miles long through a mountain on Seaton Lake.

SAN FRANCISCO, CAL.—The directors of the Pacific Gas & Electric Company decided to pass the dividend usually declared upon the common stock of the company as of July 15. In announcing the decision of the directors, John A. Britton, vice-president and general manager of the company, said that while the company has arranged for the financing of all big development work now under way or contemplated, it was deemed advisable that the company should do its part by postponing a dividend on the common stock at this time in order to make future dividends more certain. The Lake Spaulding project, he pointed out, will result in a large saving in cost of production, and the directors thought it good business to devote all available resources to the early completion of this work.

SEATTLE, WASH.—The Seattle Port Commission is calling for bids to be opened July 23rd on the mechanical equipment of the Smith Cove dock, to be used in handling lumber and heavy commodities generally. Equipment called for is in three units. A is a Geantry crane for serving an open lumber wharf 900 ft. long, the crane to have a working span of 175 ft. and to be operated entirely by electricity. B is a monorail system for handling lumber in a dry lumber shed 100 x 600 ft in length. Two electrically operated trolleys will be installed. C is a locomotive crane provided for general use at the dock and to serve the section not reached by the Geantry crane. The crane called for will be 10-ton capacity and will be of standard gauge, so that it can operate on the railway tracks and can be utilized to some extent in the moving of cars. The whole equipment is designed to be equal to the latest and best practices by the largest lumber manufacturing concerns in the country.

TRANSPORTATION.

EUGENE, ORE.—A franchise has been granted the Portland, Eugene & Eastern Railway in this city.

ANACORTES, WASH.—An application has been filed by Geo. W. Krebs for a franchise for a street railway covering all the main streets of the city.

TULARE, CAL.—Grading of the Big Four Railroad from Tulare to Poplar, a distance of 21 miles has been completed and it is stated that laying of steel will be started at once. Contracts for the rails have been let with an Eastern firm.

SEATTLE, WASH.—A tentative offer has been made to the Seattle city council by Scott C. Calhoun, one of the receivers of the Seattle, Renton & Southern street railway, to sell that portion lying within the city limits for $1,200,000. The offer is being investigated and the question of buying the entire line is also being given consideration. The line is 9 miles long.

SAN FRANCISCO, CAL.—The supervisors have fixed the date of the bond election for the extension of the municipal street railway system to the exposition grounds, for Tuesday, August 26. The board also adopted a resolution providing for the holding of a conference between the city and the harbor commissioners on the best plan for the improvement of the present terminal facilities at the foot of Market street.

TACOMA, WASH.—Judge Easterday of the Pierce County, Washington, superior court, has sustained the contention of Tacoma revoking the Tacoma Railway & Power Company franchise on the ground that it has violated its franchise by selling current for lighting purposes. The company has appealed and the case will be heard by the supreme court in October. Action is being started against the Seattle & Tacoma Power Company on the same grounds.

SEATTLE, WASH.—The city council of Seattle has accepted the Highland Park & Lake Burien Street Railway line with a view of operating it in connection with the municipal system now under construction. The line extends from West Spokane avenue to Lake Burien, a distance of about 9 miles, approximately one-half of it being in the city. With the extensions contemplated by the city the line will be about 12 miles long. That portion of the road within the city limits is a gift to the city. It is estimated that $12,000 will be required to put it in shape for operations.

LOS ANGELES, CAL.—Following a series of conferences an agreement has been reached between S. M. Haskins, an attorney, representing the Los Angeles Railway Corporation, and property owners in the southwest part of the city in regard to the proposed opening of Hoover streets, through the shoestring strip to the harbor. The street railway company offers to deed to the city property valued at $250,000 for the thoroughfare on condition that it be given the right to change from steam to electricity for motive power on the old Los Angeles and Redondo line over the land in question.

SACRAMENTO, CAL.—An ordinance opening the way for the entrance to Sacramento of all electric lines over the rails of the Northern Electric has been passed by the city commission. The ordinance also calls for the transfer of the Northern Electric tracks on Front street to Second from M to X. The franchise granted to the Northern Electric formerly provided that two additional franchises over the same rails might be granted providing the railroad lines to come shared the expenses of construction with the original grantee. The new ordinance wipes out the restriction to three lines and makes the city commission the sole judge of how many franchises shall be granted over the same rails. The Northern Electric gave up this right in consideration of permission from the city to transfer its tracks from Front to Second street. The trackage affected by the Northern Electric's abandonment of the exclusive feature of the old franchise is approximately six miles in length.

TELEPHONE AND TELEGRAPH.

SO. PASADENA, CAL.—A franchise for 40 years has been granted to the Home Telephone Company and work will begin in a few days on laying of cable.

SEATTLE, WASH.—The application of B. H. Carter and the Pioneer Farmers' Telephone Company for a permit to erect and maintain a telephone pole line on country roads Nos. 507 and 830 was granted.

WATERWORKS.

AUBURN, WASH.—The city council will submit to the people the question of voting bonds in the sum of $10,000 for the construction of a water system.

ESCONDIDO, CAL.—Bonds in the sum of $100,000 for installation of a municipal water plant were ordered at a recent election. The bonds will be placed on the market at once.

HEALDSBURG, CAL.—The purchase of the pumping plant for the water system has been referred to the water and light committee, which will employ a consulting engineer to examine the plant and prepare plans and specifications for the new equipment.

PUYALLUP, WASH.—This city will have a better water supply as soon as the city council can take action on the plans submitted by the city engineer. The proposition is to buy Maplewood Springs, which will cost $29,746, and to utilize the one acre they own and install a pumping plant.

SAN FERNANDO, CAL.—The purchase of the water system of the Maclay Rancho Water Company by the city is recommended by a special committee of the Chamber of Commerce. The plant is owned by the Consolidated Securities Company of Los Angeles, which recently offered to sell it to the city for $50,000.

PORTLAND, ORE.—Both the 24 and 20-inch submerged Bull Run water mains across the Willamette will be lowered this summer to permit the dredgng of the upper harbor south of the Hawthorn bridge by the government. A contract for the work has heen let to A. O. U. Berry for the sum of $69,400, the entire amount to be paid in city water bonds at 93 cents on the dollar.

LOS ANGELES, CAL.—The Sentinel Heights Water Company has started operations with paid-in capital of $1,000,000 and with $1,000,000 of bonds ready to be issued. The company is prepared to furnish water to 50,000 or more users on lots of the Los Angeles Investment Company in its several tracts southwest of the city. There are four wells on the property. The supply available is estimated at 10,000 or more miners' inches.

SACRAMENTO, CAL.—The Sacramento River as a future water source for Sacramento is recommended by the Chamber of Commerce water committee. The committee recommends that the chamber at once take steps to have the city secure an option on 40 acres of land north of the city as a site for the filtration plant, and urges the placing before the people of a proposition to vote $1,000,000 bonds for the plant. The actual cost of the plant is figured at $828,000.

SAN RAFAEL, CAL.—The directors of the municipal water district of Southern Marin have adopted a resolution authorizing negotiations for securing 5300 acres of the Howard-Shafter ranch as a site for the proposed municipal water plant and rights of way for pipe lines through the lands of the Marin Water & Power Company. George H. Harlan, attorney for the board, was instructed to prepare a resolution authorizing the district to open negotiations with the Marin Water Company and the North Coast Company for the purchase of those plants.

ALPHABETICAL INDEX TO ADVERTISERS

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DÜSSELDORF (GERMANY)

CONSTRUCTORS

ERECTORS

MAKERS OF

WATER TURBINE SCHEMES

AGENT FOR THE WESTERN PART OF U. S. A.

GEO. J. HENRY, Jr.

RIALTO BUILDING SAN FRANCISCO

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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MATERIALS ADVERTISED IN THIS ISSUE

Batteries
Edison Storage Battery Supply Co.

Boiler Feed Water Treatment
Dearborn Chemical Co.

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Where to Buy It in the West, Pages 9, 10.

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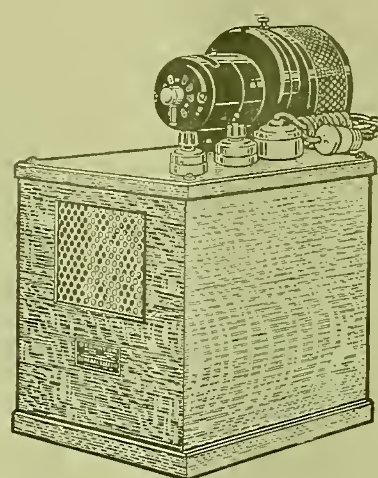

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

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THE U. S. COLLIER JUPITER

BY LELAND WEBER.

The new naval collier Jupiter with its electric propelling machinery has just been completed at the Mare Island Navy Yard. The boat is 540 ft. in length with a 65 ft. beam. It draws 27 ft. 6 in., has a displacement of 20,000 tons, carries 12,000 tons of cargo and is designed to operate at 14 knots.

The Jupiter is a sister ship to the Neptune and the Cyclops, the latter being equipped with triple expansion engines and the former with Parsons turbines connected to the propellers by mechanical gearing. In the case of the Neptune published reports state that it did not meet the contract requirements. This may be explained as the turbine speed was 1250 r.p.m., which is too slow for efficient turbine design and the propeller speed 135 r.p.m., which is too high for the most efficient propeller operation.

The method of propelling the U. S. collier Jupiter is a new engineering undertaking. The first example of turbo-electric propulsion on any scale is afforded by the city of Chicago fire-boats, Joseph Medill and Graeme Stewart. The main power unit on the Jupiter is a Curtis, 9-stage, horizontal turbine, rated at 5500 h.p. Directly connected to this turbine is a General Electric alternating current, 33-cycle, 2-pole, 5450 kw. generator. The speed of this set at 14 knots is about 2000 r.p.m. The above set is placed between the two propeller shafts and has no mechanical connection to them.

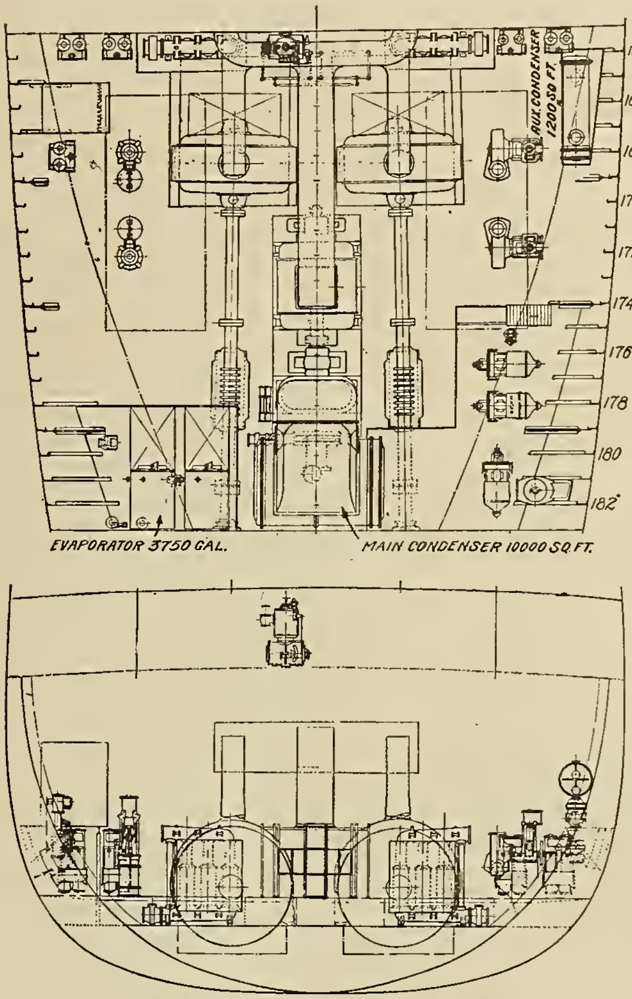
On each side of this set and directly connected to the ends of the shafts are two 36-pole, General Electric induction motors operating at 33 cycles, 2300 volts, 665 amps., and rated at 2750 h.p., making between 107 and 110 r.p.m. at normal speed. The generating unit and motors are self-lubricating and self-ventilating. These motors are electrically connected to the generators through the main switch-board. The propeller shaft is 15½ in. in diameter. Between the driving motor and the thrust-bearing the shaft is hollow to allow for the torsion meter which is of the Gary-Cummings type. Connected in this manner the torsion meter becomes a part of the shaft, and the horsepower output of the motor is read, thus making possible a complete test or analysis of the power input, the r.p.m. of the shaft, the speed of the boat, and the horsepower output.

Launching of U. S. Collier Jupiter.

The main generator receives its field excitation from 3-2 interpole General Electric d.c. generators, operating at 125 volts and 280 amps., rated at 35 kw. and making 3600 r.p.m. These exciters are each directly connected to a Curtis turbine rated at 35 kw., running at a speed of 3600 r.p.m. and designed to take steam at 150 lb. gauge at the throttle. Any or all of these exciters can be used to generate power for the lights on the ship. They are connected to an auxiliary switchboard, which is electrically connected to the main switchboard for field excitation only.

For providing resistance when starting the motor, a set of water cooled rheostats is used. These are operated by a lever at the side of each motor. A hand wheel at the switchboard is connected to the governor levers, which controls eight operating valves. This hand wheel can be set to govern at any speed desired. With this arrangement one man, standing in front of the switchboard, can reach and operate everything for running the boat. On the front of the main switchboard are six switches: four oil switches, two on each side, and a knife switch in the center. The oil switches provide the only electrical connection between the generator and the motors. One of these switches is for going ahead and one for the reverse. If there were only two oil switches it would mean that the motors would have to be connected as a unit; that is, both operate at the same speed in the same direction. The feature of the actual installation with the two oil switches for

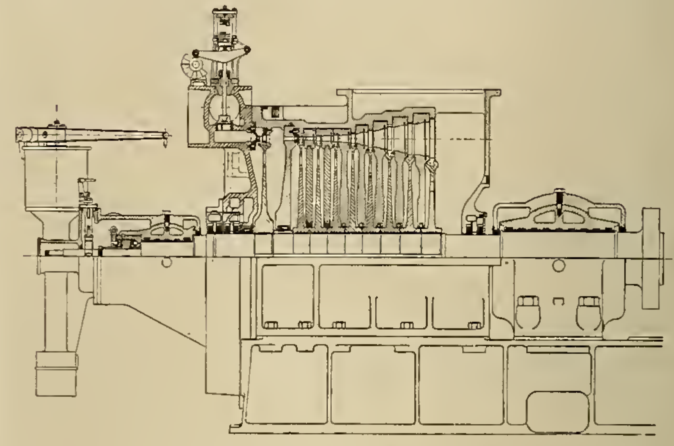
each motor, is that the motors act as separate units and are in no way connected. The fifth switch, or knife switch, is the field excitation switch, through which the power from the auxiliary or exciter switchboard is brought to the field of the main generator. Below this switch is a rheostat which regulates the amount of electricity going into the exciter field. In this way the field strength and output of the generator is governed. The action of this rheostat is not directly in the circuit of the field of the main generator but acts on the field of the exciter, and thus indirectly on the field of the main generator.



Cross Sections of U. S. Collier Jupiter.

The two levers at the sides of the motors are for cutting in or cutting out the water rheostats. There is a complete interlocking system between these levers and the oil switches on the board, so as to make it impossible to injure the motors or the generators As a further safety precaution the oil switches on one side of the board are locked against each other. This construction makes it impossible for the operator to short the leads from the generator in back of the board.

There are two methods of starting the boat. With the turbine standing, the motors may be put into operation by throwing in the ahead switch on the main switchboard, and throwing out the rheostats or resistance on the motors by means of the levers at their sides. Next, with the exciters running and a low field excitation, the turbine is started and brought up to speed, the field being strengthened until it reaches full voltage. In this way the motors will come up to speed directly as the field on the main generator builds up until the entire set is at normal speed. The second method of starting is with the turbine running. This is accomplished by pulling out the exciter field switch which is the center switch on the main board and by putting in the resistance on the motor circuit by means of the levers at the sides of the motors. Then put in the oil switch for going ahead and throw in the field switch. The operator must wait, however, until the field has built up and is at normal voltage, then he must throw out the resistance on the motors which



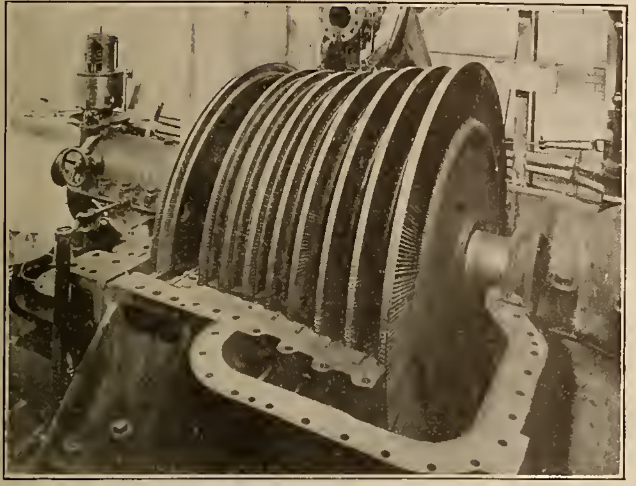
4000 kw. Nine Stage Turbine.

will come up to speed at once. From this it can be seen that it does not make any difference whether the turbine is standing or running in order to start the boat.

For reversing the engines, practically the same operation is gone through as is used when starting with the turbine running. If the boat is running at all speed ahead and the motors have to be stopped and reversed, the ahead switch must be pulled before anything else can be done. If it were possible to throw in the reversing switch with the ahead switch in, there would be a short behind the board; since the function of these switches is to reverse the direction of the current in the motors. If the ahead switch were pulled out and the reversing switch thrown in, it probably would injure the motor, as it would be running at full speed ahead and when the reversing switch is thrown in, it would reverse the full power in the opposite direction. To prevent this, before the reversing switch can be thrown, the field must be broken on the generator and the resistance thrown in on the motor. It is not necessary to wait until the motor comes to rest before throwing in the reversing switch, since when the power is thrown on in the other direction, the motor will stop itself and start in the opposite or reverse direction. When the motor has taken the new direction the resistance can be thrown out and the motor will come up to speed. The time of this reversing action was tested in the General Electric factory and found to be 40 seconds; that is, the time elapsing between full speed ahead to full speed astern is 40 seconds. Whether or not that can be equalled in the actual operation of the boat with the propellers connected to the shaft is a question that can only be answered by an actual test. It is also possible to run one motor in one direction and the other in the opposite direction if such a desire

should occur. The big advantage shown in the last statement is realized in the duty of a collier. With this arrangement, it is far easier to maneuver at sea in order to get alongside of a boat which is to receive coal. It would even be possible to have the boat swing in a complete circle with the stern as a center, if this were necessary, merely by running the propellers in opposite directions. In passing it might be stated that in general the resistance is left in on the motors in starting, reversing or maneuvering and only out when on a free run.

The boilers for supplying the steam to the turbine are 3 double-ended Scotch marine boilers and are the



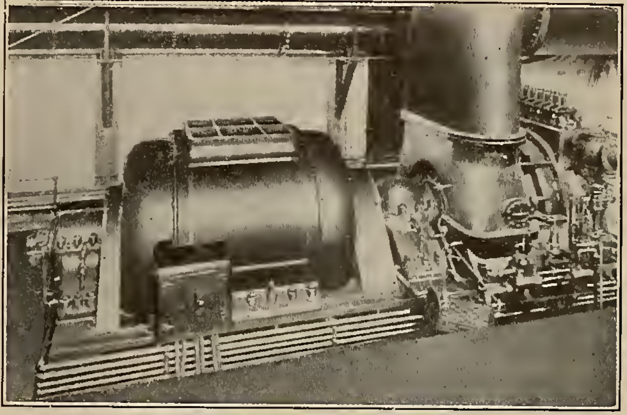
Assembly of 4000 kw. Horizontal High Pressure Nine-Stage Curtis Turbine.

largest in the United States service on the coast. The boilers are 25 ft. in length and 16 ft. 3 in. in diameter, and have a total heating surface of 19,379.07 sq. ft. In addition to the main boiler installations there is one donkey, upright fire tube boiler, 7 ft. 2 in. in diameter, which supplies steam to the hoists and other auxiliary machinery not in the engine room. The maximum boiler pressure is 200 lb., while under normal operation the pressure at the throttle of the turbine and other auxiliary apparatus is 185 lbs.

The two boiler feed pumps are vertical, 2 cylinder, double acting Blake water pumps, size 12 x 8½ x 12 in. These pumps, like all other apparatus for the operation of the ship, with the exception of the boilers, are placed in the main engine room. Only one of these pumps is required under normal operation for boiler feed purposes, the second one being an extra unit, used only in case of injury to the regular pump. In addition to the boiler feed pumps are: 1 sanitary, 1 fire, and 1 ballast pump, which were manufactured by the government at the Mare Island shops. There is also one 2-cylinder, double acting, vertical Blake water pump, size 12 x 8½ x 12 in., used to pump out the bilge water and also used as a circulating water pump for the water cooled rheostats.

The main turbine exhausts into an Alberger condenser which has a total of 6500 tubes and a cooling surface of 10,000 sq. ft. This condenser was built by the government in the shops at Mare Island from the plans furnished by the Alberger Company. The circulating water for the main condenser is furnished by two 4 in. centrifugal pumps driven by two reciprocating engines. These pumps and engines were also built at the Mare Island shops. The dry vacuum pumps are two vertical, double acting Alberger reciprocating pumps, size 10 x 24 x 14 in. The condensate is taken care of by two 3 in. centrifugal turbine driven pumps placed directly below the main condenser. There is also a Wheeler condenser set of 1200 sq. ft. cooling surface, into which the auxiliary machinery exhausts. In this way everything in the engine room operates condensing.

A 3000 gallon evaporating unit consists of a double set composed of two 36 in. Rielly multicoil evaporators and two 14 in. Rielly multicoil condensers. The function of this apparatus is to take the salt water



Turbine as Installed.

from the ocean and by a process of evaporating and condensing render it pure and fresh for drinking purposes.

The tested water rate of the main power unit was found to be 11.2 and 13.7 lbs. of water per hour per brake horsepower for a speed of 14 and 10 knots respectively. The actual weight of the equipment is 156 tons, which is a saving of about 40 per cent over the reciprocating engines designed for the boat. The ratio of synchronous speed reduction between the generators and motors is 18 to 1. The smooth running qualities of the installation, the ease of operation, and the rapidity with which reversing may be effected, indicate that this installation shuodl be an unqualified success.

EXTENSION OF ELECTRICAL PLANTS IN BAVARIA.

The electric industry has continued to extend its operations, and in spite of overtime work all the orders could not be fully executed. The demand for electric power in Bavaria is growing continually, it being used more and more for cooking, heating, and agricultural purposes. The State, however, has hitherto done almost nothing to introduce electric power for railway traction.

The Leitzach Electric Works will furnish 15,000 horsepower, and part of the plant will be put in operation in 1913. The company has a capital of $1,428,000, in which the city of Munich participates with 51 per cent. In addition, it has issued bonds for $952,000.

At Haidhof, to the north of Regensburg, the electric plant which has heretofore supplied 4000 horsepower has been doubled in capacity, and a further enlargement is planned.

ELECTRICAL PUMPING AND IRRIGATION

MEASURING DEVICES.

BY B. A. ETCHEVERRY.

To properly operate an irrigation system measurements are necessary at the following places: (1) on main canals and laterals, (2) at head of all laterals, (3) at point of delivery to irrigator. The measurements on the main canal and main laterals are desirable to know their carrying capacity at any time. The measurements, at the heads of all laterals are necessary to properly divide the water between the laterals. The measurements at point of delivery to the irrigator are necessary whenever water is sold according to volume delivered.

For a measuring device to be entirely satisfactory, it should meet the following requirements:

1st. It should not only measure the water at any one time, but it should keep a continuous record of all water delivered.

2d. In many cases it is desirable that it should maintain a constant flow when once it is set for full capacity or fraction of full capacity.

3d. It should be able to handle any fraction of its full capacity.

4th. It should not require difficult computations to obtain the results of the measurements.

5th. It should not be easily interfered or tampered with.

6th. Where the available grade is small it should require the least possible loss of head.

7th. The cost of the device should not be excessive.

The measuring devices most generally used are:

1. Rating station—Rating flume.
2. Weirs: rectangular or trapezoidal.
3. Miners' inch board or box.
4. Submerged orifices.
5. Other devices: Grant Michell meter—Kennedy Gauge Outlet.
6. Automatic registers.

Rating Station—Rating Flume.

A rating station consists of a selected section on the canal whose discharge is known for any given depth of water. To obtain this relation between the depth of water and discharge it is necessary to rate the station. This is done by taking a number of measurements of canal cross section and corresponding velocities for a wide range of discharges. The velocity is obtained by means of a current meter of measurements of depth and width. The product of the velocity and cross section gives the corresponding discharge. By plotting these results the rating curve of the station is obtained from which a table can be prepared. By consulting this curve or table the discharge for any depth of water can be obtained. In order to have a permanent station it is often preferable to place a rating flume in the canal. The rating flume consists of a short length of flume not less than 12 ft. nor less than twice the average width of the ditch or canal. The width and depth of the flume should be equal to the average width and depth of the canal. The upstream end should be connected to the earth canal by means of wings, aprons and cut off walls as previously described for flumes. Transversally the floor should be perfectly level and longitudinally it should be set to the grade of the ditch. The floor should be placed about 1/10 ft. above the grade of the ditch so that all silt may be carried through and not permitted to settle and destroy the form of the cross section.

The gauge rod should be placed at a distance from the upstream end three-fourths of the length of the flume. Where an automatic register is used the well for the float must be placed at this point on one side of the flume and connected with the water by an orifice through the side 1 in. or more in diameter. Usually a well cross section of 12 by 18 in. is sufficient.

The channel of the ditch in which the rating flume is placed or on which the rating station has been selected should have a uniform cross section and be straight for 100 ft. upstream from the flume with its axis passing through the middle of the flume. The channel downstream should not have obstructions or gates which are liable to back the water up or in any way affect the rating. The advantages of the rating flume are that it can be used for large volumes of water, is not affected by silt and does not require any loss in head or in velocity. The chief disadvantage is that it can not be used with accuracy when there are check gates or obstructions which will back the water up and change the rating.

Weirs.

The weir is the most generally used measuring device found on irrigation systems, for the reason that it is simple to construct and use and will give accurate results when properly installed. The weir is generally

Cippoletti or Trapezoidal Weir.

limited to moderate quantities of water and requires sufficient fall or grade for its installation and for these reasons can not always be used. The term weir is applied to any dam or barrier across the stream and

over which the water flows. The weirs used in irrigation consist of a board or barrier into which a notch is formed through which the water flows. The volume of water passing through the notch is obtained by knowing the length of the notch and measuring the depth of water passing over it. The form of notch is generally either trapezoidal or rectangular and in some cases a triangular or V shaped notch is used.

The trapezoidal weir is known as the Cippoletti weir and is more common than the other forms. It consists of a horizontal crest and the two sides, each sloping outward one inch for every four inches rise. The rectangular weir has vertical sides. The first form has the advantage that the flow may be computed by means of a simpler formula. The second form is a little easier to construct and is more accurate because its formula has been derived from a larger number of experiments. In either case the flow can be obtained by referring to the tables given farther.

The weir may consist of a simple board placed across the ditch or of a board set in a short section of flume or box, in which case it is called a weir box. The weir board may be of wood, metal or concrete. When made of wood or concrete it is desirable to use a metal plate to form the edges of the crest and the sides. When no weir box or flume section is used, the weir board is placed directly across the canal, and sufficiently braced with posts. A weir box or flume box is generally used. The box is a short flume section whose length is not less than 8 to 12 ft. The width and depth must be at least sufficient to give the required dimensions to the weir board. The weir board should be placed at a distance from the upstream end equal to 2/3 the length of the box, the lower third forming a floor for the falling water. The depth measurement should be made at least 4 to 6 ft. upstream from the crest, from a post or scale fixed on the side of the flume with the zero point level with the weir crest. To obtain accurate results the following rules for the dimensions of the notch should be observed.

1. The greatest depth of water which should be allowed on the crest of the weir should not be more than 1/3 the length of the weir and the least depth 1 in. The depth is usually controlled by the fall available. Where the fall available is small a large length and small depth are necessary.

2. The distance from the crest of the weir to the bottom of the canal or floor of the weir box should be at least three times the depth on the weir.

3. The distance from the edges of the weir notch to the sides of the canal or of the weir box should be at least twice the depth on the weir.

4. The upstream side of both the crest and the edges of the weir north should be brought to a knife edge or to a sharp corner; the beveling should be on the downstream side. With a sharp corner and a thickness of crest not greater than ½ the minimum depth of water the discharge will be the same as foı a knife edge.

In placing the weir in position the following directions must be followed:

1. The weir when used on a ditch should be placed in a section of the ditch which is straight for at least 50 ft. above the weir and the center line of the ditch should be perpendicular to the weir board and pass through its center. The cross section of the channel should be not smaller than the cross section of the weir box in order to have slow velocity and fairly calm water above the weir. If the weir box must be placed near the takeout gate the velocity must be made uniform by means of baffles.

2. The weir must be set high enough to give to the overflowing sheet a free fall on the downstream side. A common rule is to make the level of the water on the downstream side lower than the crest by not less than ½ the depth of water on the crest. To obtain free fall it is best to select a section of the ditch which has considerable grade.

3. In letting water in a weir box through a pipe it should discharge at the bottom of the box and depth of the box should be sufficient to produce a calm body of water on the upstream side of the weir. In some cases this requires the use of baffle boards to break up the velocity of the approaching water.

4. The crest of the weir should be level from end to end.

5. The measurement of head should show the true elevation of the water surface above the weir crest. Directly at the crest and for a short distance above it the water surface curves down. This requires that the water be measured a certain distance upstream.

When the weir has been installed the only measurement to take is the depth of water or head over the crest of the weir. To make this measurement it is necessary to provide a reference point level with the weir crest, from which the depth is measured. This point must be at least 2 ft. upstream from the weir crest for a small weir, and preferably 4 to 6 ft. For a weir box this reference point may be a nail driven part way in the side of the box at the level of the weir crest, or a bracket or support formed by nailing a strip to the side of the box. For a simple weir board a stake may be driven into the ditch. The depth of water above the reference point can be obtained sufficiently close for ordinary purposes by using a carpenter's rule and reading the depth to the nearest ⅛ in.

Knowing the length of the weir crest and having obtained the depth of water, the discharge in cu. ft. per second or miner's inches may be obtained by using the following formulae or by referring to the following tables.

Formulae for discharge with no velocity of approach:

1. Rectangular weir with end contractions; $Q = 3.33\ (b - .2H)\ H^{3/2}$

2. Rectangular weir without end contractions; $Q = 3.33\ bH^{3/2}$

3. Cippolletti or trapezoidal weir; $Q = 3.367\ bH^{3/2}$

Formulae for discharge with velocity of approach:

1. Rectangular weir with end contractions; $Q = 3.33\ (b - .2H)\ [(H + h)^{3/2} - h^{3/2}]$

2. Rectangular weir without end contractions; $Q = 3.33\ b\ [\ (H + h)^{3/2} - h^{3/2}\ ]$

Where Q = discharge in cu. ft. per second.
b = length of crest in feet.
H = depth of water over weir crest.
h = velocity head due to velocity of approach.

Table of Discharge for a One Foot Cippolettti Weir.

Depth of water on crest. inches	Discharge. Cu. ft. per second..	Depth of water on crest.	Discharge. Cu. ft. per second.
1	.08	4	.65
1⅛	.10	4⅛	.68
1¼	.11	4¼	.71
1⅜	.13	4⅜	.74
1½	.15	4½	.77
1⅝	.17	4⅝	.81
1¾	.19	4¾	.84
1⅞	.21	4⅞	.87
2	.23	5	.91
2⅛	.25	5⅛	.94
2¼	.27	5¼	.97
2⅜	.30	5⅜	1.01
2½	.32	5½	1.04
2⅝	.34	5⅝	1.08
2¾	.37	5¾	1.12
2⅞	.40	6	1.19
3	.42	6¼	1.26
3⅛	.45	6½	1.34
3¼	.47	6¾	1.42
3⅜	.50	7	1.50
3½	.53	7¼	1.58
3⅝	.56	7½	1.66
3¾	.59	7¾	1.75
3⅞	.62	8	1.83

This table is computed for a one foot Cippolletti or trapezoidal weir, but it may be used for longer weirs by multiplying the quantities given by the length of the weir in feet. For instance a two foot weir will give twice the discharge obtained for a one foot weir. An 18 in. weir will give 1½ times the values given in the table. For accuracy a one foot weir should not be used for depths greater than about 4 in. For larger discharges it is preferable to use a longer weir crest.

Table of Discharge for Rectangular Weirs With Full Contraction

Depth of water on crest inches.	Discharge cu. ft. per second for 1 ft. weir.	Discharge cu. ft. per second for 2 ft. weir.	Discharge cu. ft. per second for 3 ft. weir.
1	.079	.159	.239
1⅛	.094	.189	.285
1¼	.110	.222	.33
1⅜	.126	.255	.38
1½	.144	.29	.44
1⅝	.161	.32	.49
1¾	.180	.36	.55
1⅞	.20	.40	.61
2	.22	.45	.67
2⅛	.24	.49	.74
2¼	.26	.53	.80
2⅜	.28	.58	.87
2½	.30	.62	.94
2⅝	.32	.67	1.01
2¾	.35	.72	1.08
2⅞	.37	.76	1.16
3	.40	.81	1.23
3¼	.44	.91	1.39
3½	.49	1.02	1.54
3¾	.54	1.13	1.71
4	.60	1.24	1.88
4¼	.65	1.36	2.06
4½	.71	1.47	2.24
4¾	.76	1.49	2.43
5	.82	1.72	2.61
5¼	.86	1.84	2.81
5½	.94	1.97	3,00
5¾	1.00	2.11	3.20
6	1.06	2.23	3.41
6¼		2.38	3.63
6½		2.51	3.87
6¾		2.65	4.06
7		2.80	4.29
7½		3.00	4.47
8		3.40	5.20
8½		3.70	5.65
9		4.00	6.15
9½		4.30	6.64
10		4.64	7.15
10½		5.00	7.71
11		5.32	8.24
11½		5.65	8.78
12		6.00	9.34

The above table is for rectangular weirs with crest 1, 2 and 3 ft. long. It will be noticed that for this type of weir the discharge is not exactly in proportion to the length of the weir crest, especially for the greater depths of water on the crest.

The form of construction of the weir will depend on the conditions where it is used. It may be used on a ditch or a flume in which case it is placed either as a weir board or a weir box across the canal or flume or it may be used to measure the water taken out of a pipe in which case it is placed around the takeout valve. Unless some device is used for automatically keeping the head constant, the amount of water passing over the weir will of course vary with the rise and fall of water in the canal.

The advantages of weirs are that they are accurate and simple to install. The disadvantages are that they require considerable fall and that the canal and portion of the weir box above the crest will silt up rapidly when the water is not clear and this will destroy the accuracy of measurements.

TWENTY-FIRST ANNUAL MEETING OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

The regular annual meeting of the society for the promotion of Engineering Education was held in Minneapolis from June 24th to 26th inclusive. The principal sessions were held in the new engineering building of the University of Minnesota and in the West Hotel, the latter being a joint session with the American Water Works Association. A comprehensive series of papers was presented by members and non-members covering many of the important phases of engineering education and allied matters. Several of these took tangible form in committees appointed to carry out the suggestions presented in the papers. For example, a paper by Professor E. V. Huntington of Harvard University on The Units of Force was partly instrumental in causing the appointment of a committee on the Teaching of Mechanics to Engineering Students. In another paper Mr. D. M. Wright, of the Henry & Wright Manufacturing Company, suggested the appointment of a committee to study and report upon the standardization of technical terms. This suggestion was carried out.

The presidential address of Professor Wm. T. Magruder, of the Ohio State University, was devoted to the qualifications required in a good instructor. He pictured an ideal instructor as one who knows his subject but is also in mental reach of his students; who has the highest reputation for honesty, right living, patience and sound character; who is in practical touch with the subjects he has to teach and who has unbounded enthusiasm for the work of both teacher and engineer.

Other important papers treated of the construction of buildings for technical schools, instruction in highway and in hydraulic engineering, in shop-work and in drawing. The general subject of academic efficiency was discussed by Professor H. S. Person, Director of the Amos Tuck School of Tufts College. President A. C. Humphreys of the Stevens Institute of Technology and Professor G. F. Swain of Harvard, championed the 4-year as against the course requiring five years or longer, while the opposition was led by Professor F. H. Constant of the University of Minnesota. The results of the operation of the systematic grading system in use at the University of Missouri was described by Professor A. L. Hyde. Professor F. P. McKibben, of Lehigh University called attention to the advantages of summer work for engineering stu-

dents and explained how his students arrange for such work. A very interesting session was devoted to engineering college shop practice and engineering drawing. Professor J. V. Martenis and Mr. W. H. Richards described how shop work is made attractive and stimulating to the students by making the exercises lead to something definite. An extensive exhibit was used to illustrate the working out of the plan. Professor T. E. French of the Ohio State University, a most successful teacher of engineering drawing, showed how this subject can be taught effectively. Among other papers one by Professors C. E. Sherman and R. K. Schlafly of the Ohio State University, described a novel practice of sending civil engineering students into commercial work during the summer under the direction of instructors if the students could not obtain regular summer employment. Professor H. Wade Hibbard of the University of Missouri, presented directions for thesis work and gave a long list of subjects suitable for investigation. Mr. Ivy L. Lee, executive assistant, the Pennsylvania Railroad Company, gave some excellent suggestions from the employers of technical graduates to the teachers, indicating how the latter can exert helpful influence in the right direction, These suggestions were well received and provoked considerable discussion. In addition to the papers there were committee and officers' reports, all of which showed the society to be in good condition and alive to its opportunities.

A number of social functions and excursions increased the pleasures of the meeting and enabled the members to meet the faculty of the University of Minnesota and their families and to appreciate the remarkable beauty of the country around Minneapolis.

The following members were elected to serve for one or more years in the positions indicated: President, C. C. Anthony, Tufts College, Mass.; vice-presidents, H. S. Jacoby, Ithaca, N. Y., and D. C. Humphreys, Lexington, Va.; secretary, H. H. Norris, Ithaca, N. Y.; treasurer, W. O. Wiley, New York, N. Y.; councillors, N. W. Tyler, Boston, Mass.; J. F. Hayford, Evanston, Ill.; A. S. Langsdorf, St. Louis, Mo.; S. H. Woodward, Iowa City, Iowa; M. S. Ketchum, Boulder, Colo.; F. P. Spalding, Columbia, Mo., and P. F. Walker, Lawrence, Kansas.

THE LONGEST TELEPHONE CABLE.

A 35 mile cable for telephone connection between Vancouver and Vancouver Island has been received from England. It cost over $100,000, weighs 560,000 pounds, and the expense in laying was $20,000. Considerable customs duty was saved by the Canadian government not charging duty on that part of the cable laid below low-water mark. It is said to be the longest telephone cable in the world, and is laid at a depth heretofore not attempted, much of the line going 200 fathoms deep in the Gulf of Georgia, at one place being 1356 feet deep. By mid-July a cable will be stretched across Saanich Inlet, which will bring Victoria into much better connection with Vancouver by means of the cable just laid.

INTERDEPENDENCE.

BY S. M. KENNEDY.[1]

The total investment in the electric business represented by the member companies of the National Electric Light Association amounts to two and one-half billion dollars, and the total annual income equals four hundred million dollars. It will be noted that the electric income in the United States has now reached the sum of approximately four dollars per capita. Now it is very evident that this great industry has not made such rapid strides, and attained such giant proportions, as the result of the efforts of any individual, or group of individuals, any company, or combination of companies, or any association or aggregation of associations. No master mind has pointed the way to the goal now reached, and no wing of the industry can truthfully say, "We did it."

Every country in the world, and every man in each country loves the word "independence" for what it means, namely, national and personal freedom. Modern life and conditions, however, have demonstrated that for obtaining the best results and the greatest achievements for the energy expended the word "interdependence" means more than independence.

In the electric business, the network of interdependence is a revelation in itself. We have the inventor, the promoter, the capitalist, the banker, the central station, the manufacturer, the engineer, the jobber, the contractor, the dealer and all the subclassifications represented in each division. And then we have the consumers.

Who is brave enough to say which branch of the industry is the most important? Who dares say that his division would flourish regardless of the others? The inventor depends upon the promoter and the manufacturer. The manufacturer depends upon the engineer and designer to produce his wares, and upon the jobber, contractor and dealer to dispose of them. Then comes the central station to distribute electric energy throughout the land and create a demand for the brains of the inventor and the products of the manufacturer, and interest and educate the public to become consumers of all.

But how far could we go without the capitalist and the banker? Vast sums of money are needed in all branches of the industry. The capitalist is willing to invest provided he feels safe. Who is going to assure him of the safety of the stocks, bonds and debentures he is asked to purchase? The banker! Some might say that after all, the banker is the one who really holds the key to the situation—that he at least is independent. Not so, however, for while he has money to loan and invest he is dependent upon his depositing customers on the one hand, and upon his borrowing customers on the other. The observer must recognize that the wonders accomplished, the achievements recorded and the projects planned are less the results of operation than of co-operation and more to the credit of Interdependence than of Independence.

[1]General Agent Southern California Edison Co., Los Angeles, Cal.

READINESS TO SERVE METHODS

NEGLECTED LOAD FACTOR BUILDERS.

BY R. B. MATEER.

You, Mr. Manager, want to build up your load factor. You desire to increase the output without adding to your fixed charges! Why, then, retain the old fashioned idea that the only market for current arises from the development of lighting and industrial power business?

Only a few years ago electric irons were reluctantly permitted on the distribution systems of quasi public utilities. Now as a result of active solicitation on the part of some up-to-date managers, over three hundred and eighty thousand are in use, yielding revenue to Pacific Coast utilities equal to $190,000 per month, or $2,280,000 per annum, without increase in transformer investment or distribution system.

It was the convenience and economy of operation that caused the iron to meet with popular favor. The same can be said of other equally efficient apparatus, the toaster, the percolator, the grill, the sewing machine motor, the heating pad and vacuum cleaner; at one time regarded as luxuries, but now necessities in every modern home.

Why, then, Mr. Manager, discourage the electric range by speaking disparagingly of the apparatus, and by placing a high minimum tariff on the use of cooking equipment? You know the old fireplace gave way to the coal range, which in turn was succeeded by the oil burner and gas stove; why not investigate the electric range; the sanitary cooker; ascertain its merits, not by hearsay, but by actual experience. Be prepared for modern methods of cooking. Join hands with the manufacturer in establishing a price on the range, such as will place the appliance within reach of the public. Build your business for the future, not merely for today. What you boost today is obsolete tomorrow. So may the gas stove be compared to the electric range. You seek means of increasing the consumption of current for residence consumer. The puzzle is easy of solution; boost the electric range for residence cooking.

Typical Electric Kitchen.

Consumption—Revenue.

The average residence consumer guarantees to use current equal to twelve dollars per annum, while actual analysis of some hundreds of accounts show an average yearly revenue per consumer of eighteen dollars or one dollar and fifty cents ($1.50) per month, on business of a load factor superior to that of purely commercial business, store or office lighting.

Why not increase the revenue to five dollars per month or more, varying according to the family and its size.

From a comparison of operating costs of electric ranges, in service in California and other states, it is

evident that the consumption of current per day per person ranges from 900 watts to 1500 watts, varying upon the character of food prepared and the average family. Considering, if you please, a family of three. It is possible on the maximum rate of 1½ kw. per day per person to increase the consumption of a residence service 135 kilowatt hours per month, assuring an increase in earnings of $4.05 without additional capacity or increase in secondary feeders, where foresight was used in the original construction.

Consider how many residence consumers you supply, and assuming 33 1/3 per cent good prospects for electric ranges, determine your increase in earnings. It is velvet.

Again, if you please, the average range with a connected demand of 6.8 h.p. occasions a maximum demand of 2 kw. or approximately 3 h. p. which by reason of diversity factor in time of use, as the number of appliances increase, may be reduced to 1½ h.p., at no time in excess of the maximum demand of the average lighting consumer, eliminating one objection to the use of cooking appliances; viz. transformer capacity.

Fear not the coincidence of lighting and cooking peak. It is a spectre easily dissipated by a brief period of thought. Lighting peaks, bug-bears of a few years ago, have ceased to perplex well managed utilities, that have a well developed industrial load and who are now anxious to better conditions in residential sections. Cooking and lighting maximum demand periods or peaks, will in no case of residence use overlap. Install a meter and try it out. Bearing in mind the consumption per day per person, and the velvet, possible at this time from residence customers, using electric ranges. Let us briefly consider a few of the objections of the range as voiced by representatives of some combination gas and electric companies, obstacles hindering the rapid growth and sales in such appliances and how overcome.

Apparent Obstacles Hindering Sales.

1. Electric cooking demands increased investment in transformer capacity.

2. The range requires that we reinforce our secondaries.

3. Were all to change to electricity we would not have sufficient generating capacity.

4. Cooking load and power load synchronous.

5. Tendency to displace gas and other fuels.

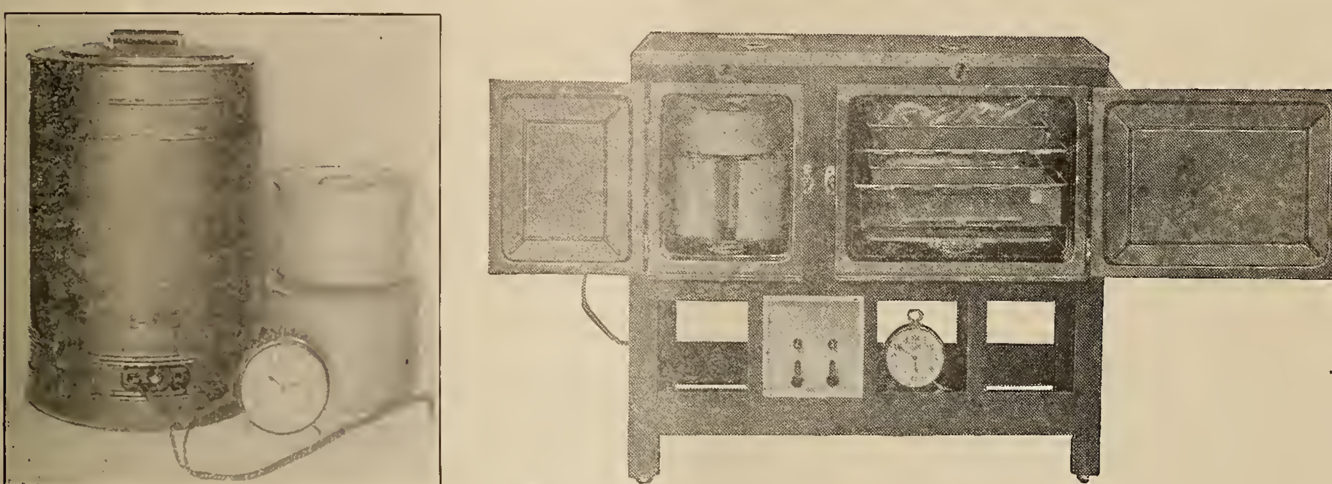
6. Possibility of unbalanced circuits.

7. Contractors and dealers push appliances. Utilities have no jurisdiction over type of appliance. Low efficiency of installed apparatus.

8. Small revenue in proportion to demand.

9. We are operating today not for the future.

Some of the reasons as given for the apparent indifferences to the electric range, such as maximum demand coincidence of peaks and revenue require no other discussion than previously mentioned. Others may be readily disposed of by stating that it is unnecessary to fear all the users of gas fuel in any city are to change at one time to the electric range. Such a development will be gradual and the additional thirty-five thousand kilowatt necessary to supply a community such as Oakland with fuel for electric cooking is available when occasion demands merely by installing additional capacity, utilizing nature's fuel, "white coal."



Electric Cooking Stoves.

Why neglect the electric range, leaving its use to be the result of a demand for service, obtained in some cases only after efforts as strenuous as a court order. Why not co-operate with dealer and contractor, encouraging wiring sufficiently heavy to utilize ranges and cooking utensils. Why place a high protective tariff ($1.00 per month per 750 watts connected upon the electric range) discriminating in favor of gas, and other fuels.

Do you, Mr. Manager, operate only for today or are you planning for the future? Do you wish velvet —increased residence consumption at a minimum of expense. In the majority of cases only that investment necessary for the purchase of an additional meter, and covered by a minimum guarantee of one dollar per month, irrespective of the connected cooking load, which you know will not exceed 5 to 7 h.p. It can be secured by active solicitation, co-operation with manufacturer and dealer and by granting a minimum monthly charge that is reasonable one dollar per month. Such a charge introduced in a city of ten thousand inhabitants combined with a meter rate of 3 cents per kilowatt hour increased the revenues from each of the three hundred homes by a sum equal to three dollars and sixty cents per month. Why not your company?

THE JOBBER AND THE CONTRACTOR.

BY F. N. AVERILL.

[This article is a clear-cut exposition of the relations existing between the electrical jobber and the electrical contractor on the Pacific Coast. It represents the essence of a paper read by the author at this year's convention of the Oregon Electrical Contractors' Association. As a brief for the jobber it is excellent. Further contributions on this subject are invited.—Ed.]

It is generally granted that the jobber is the economic outlet for the manufacturer in marketing his products, as he acts in every trade center either as a distributing agent or a direct representative of not only one manufacturer, but of many. As a result the jobber can market their goods from one place of business with one sales organization at considerable less expense than the various manufacturers if they tried to market direct, or if several of them should combine and work under one management. Further than this, the manufacturer has his accounts receivable in a comparatively few number of book accounts, and these few accounts are practically all safe ones. This explanation is one big reason why practically all manufacturers recognize and protect the jobber.

From the contractor's standpoint, one reason for the existence of the jobber is that the jobber gathers from the four corners of the country into one place of business the various lines of supply items used by the contractor in his work, and thus enables the contractor to secure from one source of supply practically everything he needs for the carrying on of his business. This stock enables the contractor many times to economize in his work, as he can go to the jobber and see a new line better adapted for a certain piece of work. Besides, the jobber can often suggest a certain line of material for a certain piece of work, due to his broader experience with the different lines on the market, where, if the contractor had to depend on purchasing from the manufacturer, he would not have the chance of changing his requirements. Very often a local jobber can and should be willing, to post the contractor on any line of new stuff that is coming on the market. He stands between the contractor and the manufacturer as to the quality of the goods, guarantees to the contractor that such items as he selects for a certain piece of work will be approved by his inspectors, or in case the article furnished is not suitable for the purpose and the inspectors turn it down, the local jobber is always ready to stand back of the contractor and see that he gets the right article for the work. In some instances, especially for slow moving merchandise, the contractor pays the jobber more money than he would if he shipped the requirements direct, but in the majority of instances he pays the jobber considerably less money than if he picked up his hundred and one requirements from as many different sources of supply. In the aggregate the costs are less.

On top of this, the jobber stands ready to assist in enlarging the contractor's line of credit in case of delayed contracts. This feature of the business is greatly abused by both sides; that is, the jobber and the contractor are both to blame. The jobber is to blame in that he is not strict enough because fearful of losing business.

The jobber has recognized the fact that the manufacturer needed him as an outlet for his product, has also recognized the fact that the contractor needed him, and as a result we not only have one or two jobbers in every trade center for this purpose; but in some cases we have nearly as many jobbers as there are contractors. As a result of the conditions which brought about the establishment of the jobber, I personally believe he is not entitled to, nor can he afford to take away the legitimate earnings of the contractor and dealer by entering into any lines of electrical business other than a purely jobbing or wholesale business and that these conditions do not make it right that he compete, directly or indirectly, with the contractor and dealer, either in the contracting or retail business. I have more respect for the jobber who comes out in the open, saying that he is operating a retail store and who retails his goods at retail prices and makes no bones of being a competitor of yours than I have for the jobber who sidesteps the retail issue, but who is, under cover, selling his goods retail at wholesale prices. The day has passed not so very long ago when jobbers made a practice of operating a contracting business along with their legitimate line and I feel that the time is passing when a jobber should operate any branch of his business to compete with the customers who make his existence possible. The opinion is quite agreed that the jobber is entitled to look for his outlet to the contractor and dealer, to the central station, isolated plant, municipal, state and national government, railroad, telegraph and telephone systems and the large industrial corporations, as it is quite apparent to anyone in the business that the demands of these buyers are such that no one other than a jobber can handle them in a successful manner as to service.

In carrying out my ideas of a jobber, he could as well be located in a warehouse or suburban location as in the heart of the city, as he would have nothing whatever to show the public, no show window displays, retail department or loafing rooms. At this time it would take a firm of strong courage and a well filled purse to put into effect all the ideas which I believe constitute a true jobber, unless all jobbers would get a change of mind at the same time.

As to the contractor and dealer, I believe the time is fast coming when the retail business will be taken care of by an electrical dealer operating a neat, well appointed store on some principal retail street, in which he makes suitable displays and demonstrations of the various lines of electrical supply items and such electrical apparatus as appeals to the shopping trade. He will do practically no contracting, but will confine himself strictly to the retailing of such items as he carries and will do only such installation work as forms a part of his sales, together with a small repair department for minor work that would come to him. He will leave the competitive bidding, the new work and the troubles of the general contracting business strictly to the electrical contractor, who will conduct his business from an office building, with perhaps a storeroom at some point where he obtains

cheap rent. Thus will come about the segregation of this business—first, the manufacturer; second, the jobber; third, the contractor, and, fourth, the dealer and retailer.

As it is today the words contractor and dealer mean practically the same thing. The majority of contractors are dealers, to a certain extent, and, so far as I know, all dealers are contractors. So in speaking of the relationship between the jobber and contractor I include the dealer in the same class with the contractor.

The dealer of today and the dealer that we will have with us tomorrow, of necessity, have to carry a certain assortment of stock, and on staple items will always buy in quantities sufficient to get them the best price obtainable from the jobber. With them this is quite necessary, as competition at the present stage of the game, not only with themselves, but with many of the jobbers, is very keen, and as they have a very much higher overhead expense to stand than the true contractor who operates from an office. To play a safe game, the true contractor should confine his purchases to exactly what he needs for certain jobs, excepting, of course, that it is policy to combine the purchases for a job ready today with the requirements of a job which you actually have ready for tomorrow. In buying your requirements for actual work on hand you many times will pay more for your purchases than will the dealer who buys in large quantities, and you may think that this condition gives this dealer who is at present doing contracting work an advantage over you, but such is not the case, as the dealer has additional overhead charges to meet which more than offset the difference in quantity price, and, furthermore, when he takes an inventory, he has a large portion of his assets tied up in merchandise, while the true contractor has his assets in accounts receivable or uncompleted contracts. I believe that the time is fast approaching when this segregation of the dealer and contractor will be recognized by the majority as the most economic manner of conducting this business.

The one great trouble with the contractor, next to the lack of capital in starting his business, has been this tying up of money (either his or his creditors) in stocks of goods which, on account of changes in the code or changes in demand, have become practically worthless, and, as a result, the contractor has been carrying them along on his books as an asset, fooling himself and fooling his creditors. Accounts receivable certainly shrink fast enough in case of liquidation, but stock on the shelves shrinks many times faster.

When the time comes that such retail stores as I have mentioned are established, then the time is ripe for the jobber to withdraw into the wholesale district or suburban district and get out of the location of high rents, which at this time is one of his principal bugbears. Under such conditions I cannot conceive of any valid reason why both the contractor and the dealer should not give their entire support to their local jobber, as he would become virtually their warehouse and would perform a service for them, and does today, for that matter, that is certainly commensurate with the returns which he gets. A better support by the contractor and dealer to the jobber in his own center enables that jobber to get together a better stock and thus becomes of more value to the contractor or dealer. A lack of this support in the past has been the cause of considerable friction and has resulted in some jobbers being competitors of contractors and dealers and has caused some dealers to compete with the jobber. This competition by the dealer with the jobber has been made possible by cheaper lines of electrical merchandise and supplies which have been on the market, but primarily by the fact that the dealer would buy in maximum quantities and then job out goods so purchased in small quantities at prices less than the jobber saw fit to handle them. To my notion, the dealer who does this is making a mistake, as the jobber who maintains his prices based on quantities delivered at one time gives the best possible protection under present conditions to the retailer.

If the time comes when all jobbers can be wholesalers in the true sense of the word and not be tempted by the retail business, it will then be possible for them to market the goods which they carry to you at two prices only, that is, an unbroken standard package and a broken package. If such a schedule were put in today by all the jobbers located in the business sections of their various cities it would mean that the retailer would be out of business and the jobber would lose money, as his expenses would then be the equivalent of the retail business.

It may possibly be that I am entirely wrong as to what is forthcoming in the jobbing, contracting and dealer's business, as there seems to be a very strong movement on foot today to absolutely dominate the electrical business from its point of manufacture until it passes into the customer's hands. The only link that is lacking in this chain is the contractor's link, as this chain now has in its make-up the manufacturer, the jobber and dealer and the central station.

Coming back to the relations between jobbers and contractors, I believe that their business relations should be mutually enjoyable, that there should be a personality in the relationship, that there is more to the business than buying and selling, and that the jobber and contractor should strive to gain mutual confidence one in the other. Be broad enough minded to not feel hurt when your jobber asks you for money. This request is not intended as a personal insult, but, like you, he needs money to run his business and there is nowhere else that he can look for it except from whom it is due.

EXAMINATION FOR ELECTRICAL MACHINIST.

The United States Civil Service Commission announces an examination for electrical machinist in the $1000 per annum. Competitors will not be required to appear at any place for examination, but will be rated on their physical condition, training, experience and fitness. Applicants for this position should be practical machinists with three years or more experience, and particularly experienced in the repair of telephones, telegraph instruments, telephone and telegraph switchboards, radio apparatus, and other small electrical instruments..

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Ship Propulsion by Electricity

"Fulton's Folly" derisively characterized the first attempt to propel boats by steam a century ago. To how complete a triumph did this folly-derided adventure ultimately attain, the progress and evolution of maritime affairs since its introduction forcefully bears record. Yet it would seem that once again another subtle force will be called upon to still further develop the niceties of propulsion aboard ship, especially in the navy.

To the layman who has acquired the habit of reasoning in efficiencies, the proposition to introduce still another element in the final product to attain the overall efficiency seems almost an anomaly. Then, it is asked why should the generation of electricity from the turbine shaft and then its reconverting into mechanical energy help matters.

Our leading article of this issue is devoted to a description of the mammoth collier Jupiter, recently completed at the Mare Island Navy Yard. The project is unique in that while certain fire boats for the city of Chicago are electrically propelled, yet this is the first example of turbo-electric propulsion on a large scale. A nine stage horizontal turbine, rated at 5500 h.p., with an actual weight of equipment of only 156 tons, is indeed a saving not to be idly overlooked.

Experiments upon turbine propelled boats non-electrically driven have in the past indicated strongly the shortcomings in their use to be largely due to their inability for pliable and easy reversal. Here again is the evident superiority of the electrically driven device. Not only may the propellers be oppositely driven, thus causing the ship to rotate with its stern as a pivot, but indeed the entire motor operation has been reversed in direction within 40 seconds when under test. Thus it is seen that reversing and maneuvering will be at a high stage of evolution upon the electrically driven sea-dog.

To Western engineers this first piece of electrically driven ship design is significant. In the first place the building of this ship in a Western port indicates strongly the general confidence the government authorities hold for Western workmanship. Again should electric propulsion prove under test in a relative unfavorable instance of this kind its unquestioned superiority, its overwhelming advantages in case of large battleships will indeed be easy of demonstration. Thus once again will the West, its enterprise and workmanship assert itself in affairs electrical.

Power and Irrigation Bureau

The application of electric power to irrigation pumping is one of the most beneficient uses to which this wonderful agent has been applied. Electricity—the mystery of the past, the marvel of the present, and the monarch of the future—has done and will do much to increase man's material comfort and prosperity, and perhaps its highest duty is that of making the desert places of this earth blossom as the rose. As soon as its convenience and reliability are fully appreciated, this ideal form of power will be universally substituted for other forms of manual and animal labor. Incidentally, this promises to

do much toward solving the problem of the high cost of living, which is based largely upon the increased cost of farm products.

But even the simplicity of electric motor operation has not been sufficiently explained to many farmers. Sometimes the power company's interest in the farmer's welfare seems to cease as soon as his load has been connected to their lines. In view of the interest that the average company is now taking in the problems of its lighting and industrial consumers, it seems no more than fitting that the same interest be taken in the agriculturist. It is a mooted question whether the service department of the electric power company should go to the expense of maintaining such supervision or whether the farmer should seek the advice of an independent agricultural engineer. Both methods are being tried. Time has been too short to determine which is the better. But a happy medium has been suggested in the establishment of a central co-operative bureau by a number of power companies to investigate and advise a large number of customers.

Particularly worthy of examination by such a bureau is the question of variation in ground water level and the subsequent changes necessary in pump equipment. While we can not but feel optimistic as to the permanency of the underground water supply, an optimism based upon engineering records for a period of years would be far more effective in convincing the "doubting Thomases." Millions of dollars have been invested in this industry throughout the West, California alone having eighteen thousand motor-driven pumps.

The proposed bureau would be an economical and efficient means of collecting and correlating information upon the amount of water pumped and the seasonal variation in water level, and it would seem to be to the best interest of the power companies to lend their support to such a movement and determine a standard depth for each district. It is to their direct benefit to educate and assist the farmer in getting the greatest water duty for the least cost of pumping plant and for the lowest power consumption. Furthermore, this would maintain the good will which they have already created among their rural consumers. A central bureau, as compared to individual company effort, would not only cost less, but would also give each member company the advantage of the experience of others in similar fields.

One of the prime reasons why many central stations have not taken on more of this desirable class of business is because of the expense of the necessary extensions and the difficulty in financing them until they become self-supporting. Yet a slight exercise of ingenuity and diplomacy would do much to accomplish the desired result. The advent of the automobile has made the adequate lighting of country roads almost as necessary as that of city streets. By arousing public sentiment on this matter, public money can be raised to supply proper lighting systems and thus electric power can also be carried to bordering farms at slight additional cost. Rural business is well worth the effort.

Business Alternations

Business, like an alternating current, changes its direction of flow at recurring intervals. Unlike the alternating current there is no strict regularity in the frequency of these intervals, though between them it alternately builds up to positive values and drops down to negative. In vain has human ingenuity tried to devise some sort of a commutator or rectifier to give a direct or undirectional flow to the course of business. In turn, has individualism, co-partnership, corporation and consolidation been tried and found wanting. The labor union also has failed as a successful means of preventing wages from following the ordinary fluctuations of industry. In spite of all endeavors the financial ups-and-downs of the past century look like a caricature of an oscillogram. Periods of prosperity and times of poverty come in well defined cycles, greatly distorted by financial surges and short circuits as well as by a complexity of other forces whose inter-relation is a problem which has not yet met its Steinmetz.

Little argument is needed to prove that general business now has a negative value. Whether this phenomenon be ascribed to the strain in European finances caused by the Balkan war and the prevalent social unrest, or whether it is due to the pending tariff and currency reform, the fact remains that the pressure and current components of business power are out of phase. Finance is lagging so far behind the bumper crops, the great mineral output and the other contributing factors of prosperity, that general business is "wattless" or idle.

Fortunately the electrical industry has suffered less than almost any other line of business. In fact we believe that the figures will show more business done during 1913 than during any year in the past. The profits may be slightly less because of higher interest rates, but the volume will be greater. The earnings of public utility companies, as shown by the semi-annual statements from all over the country, are greater than ever before, and an increasing number of people find that they must have electric light and power and they must ride on the street cars, even though general industry be drooping and it is necessary to economize on food and clothing. Electricity is no longer a luxury, but a necessity. Its vendors are among the favored few who will always do business because the demand for their services is endless.

Even in general business those who have analyzed the sinusoidal curve of industry predict that the lowest point in the present cycle has already been reached, that through legislative enactment and voluntary action, the financial interests are rapidly getting into phase, and that true business power is now being built up and will soon pass into another period of prosperity. This electrical analogy is based upon the indisputable fact that times of financial depression are invariably and almost automatically followed by periods of increased demand and prosperity. In the parlance of the day, "why worry?" The future is so bright that it needs only the spirit of confidence to assist us during a brief interval.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Geo. J. Henry Jr., consulting hydraulic engineer, has returned to San Francisco from Lake Tahoe.

H. G. Behneman, manufacturers' agent, Seattle, has returned from a four-weeks' trip to the east.

Joe Holbreck, a Sacramento contractor, was a visitor to San Francisco for a day or two during the week.

G. W. Gillespy, stores manager Western Electric Company, Seattle, spent two days in Portland last week.

John Coffee Hays, president of the Mt. Whitney Power Company, has returned to Visalia, Cal., from the East.

J. P. Peck of the Electrical Supply Company, Sacramento, was in San Francisco the latter part of the week.

L. G. Cushing, Pacific Coast representative of the Bryan-Marsh Electric Works of the General Electric Company, is at Chicago.

S. Russell of H. W. Johns-Manville Company, San Francisco, is taking an auto vacation trip through the north of bay counties.

J. H. Kelly, assistant treasurer Western Electric Company, Seattle, was in Oregon over July 4th, visiting several points in the State.

R. A. Griffin, manager pole department Western Electric Company, with headquarters in New York, spent a few days in Seattle recently.

H. B. Squires of H. B. Squires & Company, San Francisco, left the latter part of the week for an extended trip through the Pacific northwest.

A. R. Fuller of Stuart & Fuller, San Francisco, has been appointed western representative fo the S. H. Couch Company autophone systems.

E. A. Finkenheimer, special water wheel expert of the Platt Iron Works, Dayton, Ohio, has returned to Seattle, from a trip to San Francisco.

J. H. Jamison, manager Spokane office Westinghouse Electric & Manufacturing Company is recovering from a severe attack of pneumonia.

G. A. Richardson, superintendent of railway, Puget Sound Traction, Light & Power Company, has returned to Seattle from a business trip to Chicago.

C. A. Whipple has been appointed as general superintendent of the light and water department at the Eugene, Ore., municipal plant, succeeding A Myers.

A. A. Miller, manager railway and lighting division, Seattle office Westinghouse Electric & Manufacturing Company, is making a business trip to Spokane and Butte.

F. E. Wilkinson has severed his connection with the Oro Electric Corporation and has joined the Minerals Separation American Syndicate, Ltd., as assistant to the chief engineer.

A. E. Rowe, sales manager of the Telephone Electric Equipment Company, San Francisco, left the latter part of the week for a short trip through central and southern California.

A. E. Brough, manager of the Bear Lake Power Company of Montpelier, Idaho, is visiting in Salt Lake, Utah. Mr. Brough was formerly chief electrician in the shops of the Denver & Rio Grande Railroad Company there.

Raymond J. Andrus, vice-president and general manager of the Northwest Electric & Waterworks, Seattle, has taken temporary charge of the company's plant at Montesano, Washington.

J. C. Kirkpatrick, president of the National Pole and American Cross Arm Company, Escanaba, Michigan, and **Wm. Carpenter**, vice-president of the company, spent a few days in Seattle last week.

H. W. Crozier, engineer with Sanderson & Porter, is expected to return to San Francisco from the annual convention of the American Institute of Electrical Engineers on July 19th.

R. G. Littler, electrical contractor at Portland, Ore., is attending the convention of the National Electrical Contractors' Association at Chattanooga, Tenn., as the representative of the Oregon Electrical Contractors' Association.

Jos. G. Lazarus has resigned as sales manager of the California Electric Supply Company, to go into business with **Frank R. Lazarus**, his brother, as jobbers and dealers in insulating materials and electrical specialties at 171 Jessie street, San Francisco.

A. R. Loughborough of the Western Electric Company, San Francisco, has been appointed manager of that company's Salt Lake branch. **M. S. Orrick**, representative of the company in that city, will succeed Mr. Loughborough as sales manager of the company in San Francisco.

B. D. Horton, general manager of the Detroit Fuse & Manufacturing Company, and **W. T. Hessell**, New York manager for the company, are visiting the Pacific Coast. During the past week they were at San Francisco and Los Angeles and they will return by way of Vancouver.

H. M. Friendly was the delegate from the Portland Section of the A. I. E. E. to the National Convention, held at Cooperstown, N. Y., June 23 to June 27, 1913. Mr. Friendly and Mr. A. E. Burns presented a paper before the convention on the subject of "The Adaptation of Automatic Methods to Long Distance Telephone Toll Switching."

C. J. Rhodin and **G. H. Hewins**, in the engineering staff of the J. G. White Engineering Corporation, have left on a tour of inspection of the site of the new Wolverton dam and storage reservoir which the White company will construct for the Mt. Whitney Power & Electric Company on the Kaweah River in the mountains east of Visalia.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, visited the Lake Spaulding and Bear River development of his company during the past week accompanied by Charles A. Sutro, James A. McCandless, John McCandless, Chas. H. Crocker, Frank A. Somers, Dr. E. L. Dow, P. E. Bowles and C. N. Black. The company has 3000 men working on the 14 construction camps, and since the commencement of the development work last fall the company had expended, to July, $4,500,000 in this work alone and before the present developments are completed another $4,500,000 will be paid out. With other improvements in contemplation the entire project will cost approximately $15,000,000. Up to July 1 the Lake Spaulding dam had been raised 65 ft. above bedrock and concrete is being poured in at a rate of 1500 cu. yds. per day. Steel for the Drum power house is up, concrete for roof and walls is being poured and foundations have been laid for two generators, now en route from the East. Two other power developments are in progress, one in Christian valley and the other in Auburn ravine, one mile below Auburn. Steel towers to carry a voltage of 100,000 have been completed to Cordelia, a distance of 109 miles.

OBITUARY.

J. Y. Coffman, owner of the Chehalis, Washington, telephone system, died at his office in that city on July 10. Mr. Coffman was 66 years old and had resided in Chehalis since the early '90s.

MEETING NOTICES.

Oregon Society of Engineers.

The Oregon Society of Engineers are making every effort possible to have a "technical man" placed on the civil service commission of Portland, Oregon. The engineers feel that it is only just and proper that a "technical man" should sit upon the commission and supervise examinations relating to engineering subjects.

Salt Lake Electric Show Association.

At a recent meeting of the Electric Show Association it was decided to postpone the Electric Show which had been contemplated for the first week in October of this year until next spring. Owing to the numerous attractions in Salt Lake City this summer and early fall it was thought that an electric show in April would be of greater interest to the public.

Salt Lake Jovians.

Statesman Leo Brandenburger plans to hold a Rejuvenation of the Sons of Jove Friday, October 3d in this city. Most of the electrical men of this territory avail themselves of the reduced rates to Salt Lake City for the Utah State Fair and Mormon Conference, and the local Jovians will take advantage of this fact to raise their potential a few degrees by initiating them into the Jovian order.

Seattle Jovian League.

There was a good attendance at the Seattle Jovian League lunch held at the Rathskeller on Friday, July 11. The chief thing in hand was unfinished business in relation to the special luncheon to be given on July 18th. Preliminary to the completion of this business short addresses were made by H. J. Gille, sales manager for the Puget Sound Traction, Light & Power Company, Norwood W. Brockett, secretary of the Northwest Electric Light & Power Association and others. Mr. Gille's talk had to do with the progress of Jovianism and that of Mr. Brockett with stirring up interest in the convention of the Northwest Electric Light & Power Association to be held on September 3, 4 and 5. Special mention was made of the fact that one evening of the time when the convention is in session will be turned over to the Jovians for rejuvenation purposes. Complete arrangements were made for the luncheon on the 18th, including arrangements for financing the affair. Ample provision has been made for entertaining a large crowd.

NEWS OF WASHINGTON PUBLIC SERVICE COMMISSION.

The commission has suspended for 90 days from July 16, the new air line long distance tariff proposed by the Pacific Telephone & Telegraph Company which was to have gone into effect on the date named. The commission will investigate the reasonableness of the rates under complaints already on file. The rates proposed would increase the charges across the State but it is claimed by the company that short-distance charges would be decreased in many cases. Under the proposed system the state is laid out in six-mile squares, the air line basis of computation being the distance between squares.

TRADE NOTES.

The Inland Empire Paper Company, Spokane, has ordered from the General Electric Company two 1200 h.p. synchronous motors.

Charles C. Moore & Company, Seattle, have received the contract to furnish two 10 h.p. boilers for the Weart building at Vancouver, B. C.

The General Electric Company, Seattle, has been awarded a contract by the Puget Sound Traction, Light & Power Company at Bellingham, for three 500 kw. water cooled 60,000 to 2300 volt transformers.

The Standard Underground Cable Company, Seattle, is furnishing the cables for the Cashmere, Washington Lighting plant and the cables are being manufactured at the Oakland, California, factory of the company.

Pierson, Roeding & Company, Seattle, have been awarded the contract for Orangeburg fibre conduit for the underground installation in connection with the cluster light system being installed at Boise, Idaho.

The first installation in the northwest of the General Electric park way ornamental luminous type of inverted arc lamps has been installed on General Electric ornamental lamp posts in Peninsula Park, Portland, Oregon.

The Pacific Electric Manufacturing Company, San Francisco, recently furnished the Great Western Power Company with four 100,000 volt tower switches for use in connection with the Antioch substation. The same type of switch was furnished the Mississippi River Power Company for use on the Keokuk Development.

The central station companies and supply dealers of Salt Lake, Utah, report a rather interesting result of the recent reduction in the price of Mazda lamps. Whereas formerly the greater call for lamps was in the 15 and 25 watt sizes for residence use, so that the sales of 25 watt lamps were twice as great as the 40's, the conditions now are practically reversed, with a considerable call for the new small bulb 60-watt lamps. It is apparent that as the prices of Mazda lamps are reduced the reduction in revenue from the sale of current will be less marked with the substitution of Mazda for carbon and Gem lamps.

The Fort Wayne Electric Works of the General Electric Company, Seattle, secured the following contract for equipment at the Tacoma substation: Six 1500 k.v.a. 50,000 volt primary, 2300 volt secondary 60 cycle oil insulated water cooled, shell type transformers; 41 disconnecting switches; 7 oil switches; 2 aluminum cell lightning arresters and 4 potential transformers, 50,000 volt primary, 100 volt secondary. The transformers are to be duplicates of 6 transformers already installed in the substation and will complete the installation. The total transformer installation sold by the Fort Wayne Electric Works to the city now comprises twelve 1667 k.v.a. transformers at Nisqually and twelve 1500 k.v.a. transformers at the Tacoma substation. The contract was awarded at approximately $25,500.

ELECTRIC LIGHT AND POWER ASSOCIATION CONVENTION.

Norwood W. Brockett, secretary of the Northwest Electric Light & Power Association announces that the date for this year's convention has been set for September 3, 4 and 5, at Seattle. All of the companies have promised large representation and delegates from Washington, Oregon, Idaho and Montana will be in attendance. Full announcement of the convention's program will shortly be published.

COPPER CLAD WIRE LITIGATION DISMISSED.

Important litigation in regard to Copper Clad Wire which has been pending in the United States Court in Pittsburgh for the past two years between Duplex Metals Company complainant and the Standard Underground Cable Company defendant, was virtually decided June 25th when the case came before the court on motion made by complainant to dismiss the bill in respect to patent infringement. The bill as originally filed charged infringement of the patent and infringement of a trade mark. The motion made by complainant was to dismiss without prejudice; that is to say a dismissal leaving the complainant in a position to renew the suit at its pleasure. The motion was opposed, defendant contesting that the bill should be dismissed in this regard and a dismissal should be on the merits of the question.

The order of the court directs that the complainant pay the costs. The only portion of the suit not thus disposed of is in regard to the right to use the trade name "Copper Clad" and which is expected to go to a hearing in the early fall.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

NEWS OF ELECTRICAL CANTRACTORS.

The Morrison Electric Company have completed their electrical contract in the new Waverly Golf Club.

The M. J. Walsh Company, of Portland, have just completed the second half of the electrical installation in the Standard Oil Company's plant near Linton, Oregon.

NePage, McKenny & Company, Seattle, have the contract for installing the electrical fixtures in the building of the Phoenix Brewery Company, Victoria, B. C., at $1000.

The Western Electric Works of Portland, Oregon, are rewiring the Corbett Estate Building on the southwest corner of Fifth and Stark streets, which was recently damaged by fire.

The W. L. Bradley & Company obtained the electrical contract for the concrete apartment house of M. J. Buell, located on the northwest corner of Thirteenth and Main streets, Portland, Oregon.

The West Coast Engineering Company of Portland was the low bidder for decorative post lighting on the Twelfth street bridge, and the Pacific Fire Extinguisher Company was the low bidder on the Union avenue bridge.

Davis & Hull, electrical engineers and contractors, Tacoma, have been awarded the contract for wiring the 10-room residence of S. C. Knowles on North Fourth and J streets, same to be wired with conduit and provisions made for electric heating and cooking.

At noon July 11th, the electrical workers on the Northwest Bank Building in Portland went out on a strike. The cause of the strike was the fact that the Pacific Fire Extinguisher Company had "signed up" with the McNulty faction of the Electrical Workers Union in San Francisco, while the electrical workers belong to a faction known as the Reid faction in Portland.

W. H. Smith Electric Company, Portland, has obtained the electrical contract for installing a complete system of lineolight show case and show window fixtures in the new $50,000 jewelry store of Feldenheimer's, located on the southwest corner of Park and Washington streets. This company also has the electrical contract for the new warehouse of the Pacific Bridge Company.

Gray & Barash, electrical engineers and contractors, Seattle, are putting in a complete water system for the Golf and Country Club at the highlands, consisting of a direct connected motor-driven pump operating against a 350 foot head with a capacity of 500,000 gallons every 24 hours. They have just finished installing 15 General Electric individual motors, ranging from 2 to 40 h.p. in the packing plant of Barton & Company. The supplies for each of these jobs were furnished by the Pacific States Electric Company.

NEW ELECTRICAL ORDINANCE FOR SAN FRANCISCO.

(Continued.)

Sec. G. All buildings or other structures wherein electrical wires are to be installed without the additional protection of a metallic armor the same may be installed by means of porcelain bushings where such wires pass at right angles to timbers, and where such wires are parallel with timbers they shall be supported on porcelain knobs; provided, however, that in no case shall a wire be nearer than one inch of the timbers. Where porcelain knobs and bushings are used the wire shall in all cases be treated as bare electrical wire and in no case shall the insulation of the wire proper be depended upon for perfect insulation. Where the use of non-metallic conduit is advisable nothing in this ordinance shall be construed to prevent its use in connection with a knob and bushing installation.

Sec. H. In all cases where conductors for the carriage of electricity are to be installed, enclosed in metallic armor, the same shall be installed in rigid iron conduits the minimum wall thickness of which shall be .100 inches, and the minimum internal diameter .62 inches; or where said conduits are to be installed on interior surfaces they may be enclosed in metal moulding constructed of iron or steel with backing at least .050 inch in thickness, and with capping not less than .141 inch in thickness, and so constructed that when in place the raceway will be entirely closed, thoroughly galvanized or coated with an approved rust preventative both inside and out to prevent oxidation, or, said conductors may be installed in other armor material, weight and form of armor must be such as to afford under conditions likely to be met in practice, protection, substantially equivalent in all respects to that afforded by unlined rigid conduit. In all cases the entire metallic system shall be effectively and permanently grounded. No conduit or other armor shall terminate other than in an accessible metallic fitting and be continuous from fitting to fitting.

Sec. I. No group or receptacles exceeding twelve in number or consuming more than six hundred and sixty watts shall be dependent on one cutout, except decorative lighting system, footlights, borders and procenium sidelights in theatres, which shall not exceed twenty-four receptacles nor consume more than thirteen hundred and twenty watts.

Sec. J. Each and every electrical installation shall have a main service switch independently controlling each and every service connection that may be installed. All main service switches shall be installed at the point of entrance of any underground service and in the case of overhead service the main service switch shall be located at the termination of the overhead service wires in buildings not over seven (7) feet from the floor and in an open and unobstructed place, and shall be operated from a point within the main entrance of all buildings or other structures not more than five (5) feet from entrance door. The swtich operating the main service switch shall be enclosed in a metal frame and box with a clear glass face not less than one-quarter inch thick, provided, however, the current used for the operation of all elevator motors shall not be disconnected by the operation of main service switches. All meters in each and every electrical installation shall be installed at the same location as the main service switches.

Sec. K. In any building or other structure where more than six electric meters are to be installed, a special room shall be set aside for their reception. The height of said room shall be not less than seven (7) feet high, the width not less than five (5) feet wide, and a wall area permitting 18 x 18 in. for each meter required, and 18 x 18 in. for each main service switch.

The above rooms shall be fireproofed with metal lath and plaster, or metal, and a sufficient wood facing to support meters and other apparatus required and be readily accessible.

Sec. L. All wires hereafter installed in or on all buildings or other structures in the city and county of San Francisco, except in dwellings and flats as the same are now or may hereafter be defined in the building law of the city and county of San Francisco, and used for the purpose of conducting electricity shall be enclosed in iron conduits or other armor, as hereinabove set forth.

(To be continued.)

FINANCIAL NOTES.

The Pacific Gas & Electric Company report gross earnings for the five months ending May 31, 1913, were $6,796,000. Net earnings, after payment of taxes, were $2,989,500. The surplus, after charges, was $1,408,600. The balance, after payment of dividends on preferred stock, was $1,158,600.

For the month of May the gross was $1,310,676, the net was $553,495 and the surplus was $234,000. The company intends to issue $4,500,000 one year 6 per cent notes, the proceeds of which are expected to care for its financial requirements until market conditions have improved, and $5,000,000 debentures and $5,000,000 first and refunding bonds, recently authorized by the California Railroad Commission, can be sold on a more favorable basis than at present.

The Central California Gas Company has issued its regular semi-annual statement for the fiscal year ending June 30. For the year the gross earnings increased 17 per cent, while the net earnings were 90 per cent better. Earnings of the new pipe line passing through Exeter and Lindsay are reflected in this statement. Connections are being made rapidly in both of these cities. The statement rendered by the company is as follows:

Six months ending June 30—		
Gross revenue	$44,568.16	$51,888.23
Operating cost, including maintenance, insurance and taxes	31,519.36	27,934.50
Net earnings	$13,048.80	$23,953.73

A gain of approximately 90 per cent in net earnings.

June earnings of the Northern California Power Company, consolidated, of San Francisco, show a considerable increase over the earnings for the same month last year. The estimated operating surplus is about double that of 1912. This company supplies Shasta, Tehama, Glenn, Butte and Colusa counties with electric light and power, and supplies water and gas in Redding and Willows.

Figures given out by the company follow:

Gross earnings—June, 1912, $62,288.80; June, 1913, $70,263.36; increase, $7,974.56; percentage of increase over corresponding month last year, 12.8.

Estimated operating surplus—June, 1912, $9,549.18; June, 1913, $18,928.32; increase, $9,379.14; percentage of increase over corresponding month last year, 98.2.

Authority has been granted by the California Railroad Commission to the San Joaquin Light & Power Corporation to issue $1,776,000 of bonds. The company was also given authority to pledge these bonds for an issue of two-year six per cent collateral trust notes. It was provided that notes may be issued up to 75 per cent of bonds pledged.

The board of directors of the Oakland, Antioch & Eastern Railway have placed in circulation among their stockholders a subscription list to the recently authorized $1,000,000 bond issue at $85 and interest. If they succeed in raising by this method the money required to pay for needed equipment the proposed assessment on capital stock will not be levied. But if the bond subscriptions be not sufficient two assessments will be levied. One of these of $10 per share will be against the 35,000 shares of capital stock of the Oakland & Antioch Railway and the other of $5 per share against the 100,000 shares of capital stock of the Oakland, Antioch & Eastern Railway.

The Los Angeles Gas & Electric Company, Santa Barbara Gas & Electric Company and Long Beach Consolidated Gas Company have reported earnings, the former reports for five months and the two latter for four months as follows:

Los Angeles Gas & Electric Company: Five Months.	1913	1912.
Gross	$2,195,025	$1,874,703
Operating	1,183,741	1,012,744
Net	$1,011,384	$ 861,959
Interest	166,791	162,013
Surplus	$ 844,593	$ 699,946

For the first five months in 1913 gross increased $320,322 (17 per cent) and net earnings increased $150,000 (17 per cent) over the earnings for a similar period in 1912. Net earnings are equal to six times bond interest, the increase in net earnings alone almost equaling interest charges.

Santa Barbara Gas & Electric Company: Four months.	1913.	1912.
Gross	$90,426	$85,669
Operating	47,676	54,132
Net	$42,750	$31,537
Interest	13,480	12,971
Surplus	$29,270	$18,566

For the first four months in 1913 gross increased $4757 (4 per cent); operating decreased $6456 (12 per cent), and net earnings increased $11,300 (35 per cent) over the earnings for a similar period in 1912. Net earnings are equal to a little over three times interest charges, the increase in net alone being 84 per cent of total interest charges.

Long Beach Consolidated Gas Co.: Four months.	1913	1912.
Gross	$73,204	$55,289
Operating	48,016	36,231
Net	$25,188	$19,058
Interest	9,011	8,783
Surplus	$16,177	$10,275

The first four months in 1913 gross increased $18,000 (32 per cent) and net earnings increased $6130 (32 per cent) over the earnings for a similar period in 1912. Net earnings are equal to 2.7 times bond interest for this period.

The Economic Gas Company of Los Angeles has been criticised by the California Railroad Commission in a decision rendered by the commission, in which the corporation was given the right to issue $270,000 in bonds, and denied the authority to issue $365,000 in bonds. The commission declares that $295,000 of a recent issue of $930,000 in bonds were issued prior to the effective date of the public utilities act, and that $635,000 of the bonds were issued illegally thereafter, but finds that the company may properly issue $270,000 of bonds to replace an equal amount of the void bonds, the proceeds to be used to refund indebtedness. The company is also required to notify the holders of the void bonds that they are illegal and were issued without proper authority. In its find the rate board declares L. P. Lowe, head of the gas company, formed a company called the California Light & Fuel Company and thereafter issued a large number of bonds to Lowe and to the Light & Fuel Company. This is what the commission declares was a "financial flimflam."

The California Railroad Cammission has rendered a decision granting authority to the Central California Gas Company to use bonds heretofore authorized in the sum of $7,000,000 and its preferred stock heretofore authorized in the sum of $5300, for certain improvements to its gas plant in the city of Visalia. The decision states that C. S. S. Forney, president of the Central California Gas Company, has organized the General Operating & Construction Company, and that in his capacity as president of the gas company has allowed himself to profit in his capacity as president of the construction company. The commission finds that certain work to be done for the Central California Gas Company was estimated to cost $105,000 and the allowance was made for such an expense by the gas company. Thereafter Mr. Forney let the contract of the gas company to the General Operating & Construction Company of which he is president. This construction company did the work for $85,000. The commission finds that there was a profit for the construction company of approximately $15,000 on this work. As a condition of its order granting the application, the commission requires that the profit accruing to the construction company be waived. The commission requires also that no further moneys shall be paid by the gas company to the construction company without the commission's order.

NEWS NOTES

INCORPORATIONS.

BOISE, IDAHO—Articles of incorporation for the Butte, Boise & Winnemucca Railroad Company have been filed with W. L. Gifford, secretary of state, with a capital stock of $40,000,000. Chester N. Halverton of Boise is secretary.

OREGON CITY, ORE.—A new railroad from Oregon City to Portland has been incorporated. It is known as the Portland & Oregon City Railway Company and is incorporated for $200,000 by T. O. Fletcher, B. E. Fletcher and Frances Vandermeer. Electricity or gasoline motive power will be used.

SALT LAKE, UTAH.—The Hoppie Electrical Company has been incorporated with a capital stock of $500,000. The company will manufacture audiographs and telephone repeaters. Curtis B. Hawley, president and general manager of the Intermountain Electric Company of this city, is president of the company, L. S. May is vice-president and Murray C. Godbe secretary-treasurer.

ILLUMINATION.

ALBANY, ORE.—The city council has granted a franchise for a gas plant to G. L. Rauch, Portland.

SUTTER CREEK, CAL.—Sealed bids will be received until July 21 for an electric lighting system in this city.

MEDFORD, ORE.—The establishing of a gas plant for this city is being considered. W. J. Hillis and Dr. E. H. French are behind the proposition.

SACRAMENTO, CAL.—The Oro Electric Company has been granted a franchise to bring its power lines into the county over and on the county roads.

LOS ANGELES, CAL.—Sealed bids will be received up to July 28th for furnishing the necessary equipment and lighting with electric lights certain streets in the Westgate lighting district.

BARSTOW, CAL.—The Southern Sierras Power Company has taken over the electrical department of the Barstow Utility Company and further developments of light and power may be looked for.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has made application for three lighting franchises, one for territory in North Seattle and the others in Kirkland and Redmond.

LOS ANGELES, CAL.—The Board of Supervisors has adopted plans and specifications for the installation of a lighting system in Van Nuys lighting district. Bids for same will be received up to July 28th.

CENTRALIA, WASH.—The Washington-Oregon Corporation which furnishes power to practically all of the smaller towns of southwest Washington, has purchased the electric light plant at Woodland and will remodel it.

CENTRAL POINT, ORE.—Representatives of the California-Oregon Power Company have discussed the proposition with the council for another line for electric current to the city pumping plant, and the matter will be taken up at once.

SAN DIEGO, CAL.—Plans and specifications for a more economic system of ornamental street lights, recently completed in the office of the city engineer, are ready to be reported to the council. The classes of lights to be submitted are class A, B and C. All of these types are to combine illuminated street signs.

GALLUP, N. M.—An election will be held on a day to be fixed later for the purpose of submitting to qualified voters the question of granting a franchise applied for by the People's Light & Power Company for the right to erect and maintain an electric power and light plant within the corporate limits of the town.

SALT LAKE, UTAH.—Information has been received at the local land office that approximately 1445 acres of land located on Huntington Creek in Emery and Carbon counties have been withdrawn from entry, settlement and location and reserved for water power sites. The action is in accordance with an executive order of May 27, 1913.

TWIN FALLS, IDAHO.—The Beaver River Power Company has accepted the power franchise granted it by this city about sixty days ago and proposes to start work within a short time. This company, which is controlled by the Nunns, has a plant on the Malad River. It has entered the territory in the vicinity of Twin Falls in competition with the Great Shoshone and Twin Falls Water Power Company, and is making sweeping reductions in rates wherever active competition exists. The franchise provides for a maximum lighting rate of 12c per kw.-hr., and it is promised that the lighting rate when service is inaugurated, will not exceed 9c. The company has also obtained franchises in Hagerman, Buhl and Filer.

BAKERSFIELD, CAL.—Manager A. E. Wishon of the San Joaquin Light & Power Company says: "Gas consumers of Bakersfield cannot expect a reduction for the present at least. The present maximum rate of $1 a thousand cu. ft., is a means of compromise in connection with the pending litigation between the Bakersfield Gas & Electric Company, a subsidiary of the San Joaquin Light & Power Company, and the city of Bakersfield, growing out of the passage by the city trustees of an ordinance fixing the price of gas to 50c a thousand. The ultimate results will justify, if the rate of increase continues, a lower rate to the smaller consumer. But at present the net income on operations of the local plant, as indicated by my statement to the city trustees, will not justify a reduction in rate." In connection with the enlargement of the hydraulic electric generating plant in Kern River Canyon, which work is now getting under way, Mr. Wishon stated that the rebuilding of the power line from there to the local steam auxiliary station would be started in the near future. The voltage of the line will be increased from 10,000 to 60,000, the plan being to ultimately tear down the present carrier. The distance between the two plants is 14 miles, and the work of rebuilding the line will be carried out at an expense of approximately $2500 a mile.

TRANSMISSION.

VANCOUVER, B. C.—The Bridge River Co., Inc., is planning a development in the Lillooet district by which 200,000 horsepower will be developed, at an approximate cost of $8,000,000. The development includes a large dam on the Bridge River and a three-quarter mile tunnel.

LOS ANGELES, Cal.—Another $150,000 will become available for aqueduct power development in the near future as a result of action by the board of public works, who adopted resolutions increasing the amount to be paid back to the

power bureau by the aqueduct bureau for money advanced to complete joint tunnel work, from $600,000 to $750,000.

BOISE, IDAHO.—Attorneys for the State Bank of Chicago have filed a petition in the Federal Court here to foreclose a mortgage of $3,319,000 against the Idaho-Oregon Light & Power Company, because of a default in the payment of $95,345 in interest on the bonds due and payable April 1st. It is announced by officers of the company that this is the first move in a reorganization and consolidation of the Idaho-Oregon Light & Power Company with the Idaho Traction Company, operating all the interurban lines in this immediate vicinity.

TULARE, CAL.—Members of the new board of trade have made calls on stockholders of the Tulare Power Company to secure their consent to the pooling of stock in the reorganization scheme now being carried on. Attorney Drew states that over 2000 shares have been placed in the pool up to this time. The new plan of financing the company is through five trustees, two of whom are to be chosen by the Assets Realization Company of Chicago, two by the power company and the fifth to be chosen by those four or by the railroad commission in case of disagreement.

TRANSPORTATION.

FRESNO, CAL.—The Fresno Traction Company has been granted a franchise for a street car system from the city limits to San Joaquin River near the Riverside Country Club.

PORTLAND, ORE.—Formal application has been by the Portland Railway, Light & Power Company for a franchise for the first of the proposed cross-town street car lines on the East Side.

FRESNO, CAL.—News reached this city recently to the effect that the Big Four Electric Railway which now has a portion of its line completed from Tulare to Woodlake, will apply to the State Railroad Commission for permission to increase its capital stock to $5,000,000 with the intention of extending its lines north into Dinuba, Hanford and Fresno. The road is now graded as far as Woodlake, a distance of a little over 21 miles from Tulare, and work is started on the branch toward Porterville. The roadbed is ready for the laying of rails and this will be done as soon as the steel arrives, which has already been ordered. During the past week officials of the company incorporated the town site of Woodlake with a capital of $15,000. Deeds were filed at Visalia to property on which will be erected passenger and freight depots and general office buildings for the Big Four Electric Railway at Tulare. The buildings which will be erected without delay, upon the property will cost in the neighborhood of $75,000. The site will afford connection with both the S. P. and Santa Fe.

TELEPHONE AND TELEGRAPH.

YUMA, ARIZ.—The crew of the Mountain States Telephone & Telegraph Company which has been operating in Yuma for some time, has completed its labors and left for Deming, N. M., to install similar service for the company.

VANCOUVER, WASH.—O. J. Olsen of Yacolt, and Ed. Murphy were in the city interesting Vancouver men in a project to get a direct phone line from Vancouver to Yacolt. It is planned to construct the line by way of the Lewis River and thus have a straight line between the two places.

HOOD RIVER, ORE.—The Oregon-Washington Telephone Company has been organized as a consolidation of the Home Telephone Company of Hood River, Ore., the White Salmon Valley Telephone Company and the Goldendale Telegraph and Telephone Company.

WATERWORKS.

HAYWARD, CAL.—The San Lorenzo Water Company has been notified to go ahead with laying of improved water pipes.

PROENIX, ARIZ.—At an election held in Phoenix recently for the purpose of voting on whether the Water Users' Association should take over the distributing system of the Salt River project to operate and maintain at their own expense, the proposition passed by a vote of 3 to 1. The vote is regarded as only advisory.

SILVER LAKE, ORE.—At a meeting of the city council it was decided to install a complete fire and water system. City bonds to the amount of $2500 to run five years and bear 6 per cent interest will be issued.

GOLDENDALE, WASH.—The bid of the Consolidated Contract Company of Portland for work on the water system for $21,000 was accepted. This is for building the reservoir and the first four miles of pipe line.

LOS ANGELES, CAL.—A contract for the installation of a water system at National Boulevard Heights, has been let to Robert Marsh & Company. Approximately 25,000 ft. of pipe will be laid. The Erwin Heights Water Company will supply the water.

PORTLAND, ORE.—The Commercial Club of Oregon City has made formal application in behalf of that city for the extension of a pipe line to supply them with Bull Run water. Commissioner Daly will investigate the possibilities of such an extension.

VOLLMER, IDAHO.—Bids for the construction of a water works system at this place have been called. The specifications call for the construction of a pumping plant, tank and pipe lines. The system is to be completed this summer and will cost about $10,000.

PENDLETON, ORE.—At a special meeting of the council the bid of the American National Bank of this city for one-half of the $200,000 water bonds was accepted, and the bank was given a 30-day option on the other half. The bid was for 96½ cents on the dollar, and the amount becomes available at once. Now that half of the bonds are sold the city will proceed with the gravity water system.

RIVERSIDE, CAL.—The city council has voted to purchase the Garner Tract of water bearing land in San Bernardino basin. The Riverside Water Company had an option on the tract to develop water, and when it sold its water plant to the city it turned over the option also. The price is $12,300 for 30 acres. The tract will be used to develop surplus water needed for the city's domestic supply.

GLENDALE, ARIZ.—An election has been called for August 7th for the purpose of submitting to the qualified voters the question of incurring a bonded indebtedness in the sum of $35,000, for enlarging and improving the water works and purchasing same. Said bonds will be of the denomination of $500 each and bear interest at the rate of 6 per cent per annum, payable semi-annually.

HOLTVILLE, CAL.—At a recent meeting of the directors of No. 2 Water Company it was decided to proceed at once with construction of an additional five miles of ditches and laterals, and work has already begun. Work on the east canal, of which there remains two miles to be completed, will be started the first of October. A loan of $25,000 has been made to carry out plans.

SAN DIEGO, CAL.—That it will probably be necessary to call a bond election in the near future for the development of a water impounding and distributing system of the city was the decision of Mayor O'Neall and members of the council in conference. Superintendent Fay and Hydraulic Engineer Whitney will shortly submit plans for improvements. The first improvement planned is a dual line from Lower Otay reservoir to the city.

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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JOURNAL OF ELECTRICITY
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VOLUME XXXI SAN FRANCISCO, JULY 26, 1913 NUMBER 4

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ELECTRICAL EQUIPMENT OF SAN FRANCISCO HOSPITAL

BY C. F. BUTTE.

The importance and extent of an electrical installation within hospital buildings is of sufficient interest to warrant a description of that in the new City and County of San Francisco Hospital. The buildings are situated in the form of a cross, the power house, service building and laundry in the rear forming one leg, the receiving building, ward buildings and nurses' home, forming the center leg and the administration building forming the front leg. The distance from the receiving building to the nurses' home is 860 ft. with one continuous corridor 780 ft. long. The administration building is 79 x 171 ft., three floors and basement; the power house 185 x 99 ft., two floors; the receiving building 204 x 111ft., five floors and basement, and four ward buildings, each 212 x 30 ft., four floors and basement; service building 171 x 109 ft., three floors and basement and nurses' home, 148 x 84 ft., three floors and basement.

New City and County Hospital at San Francisco.

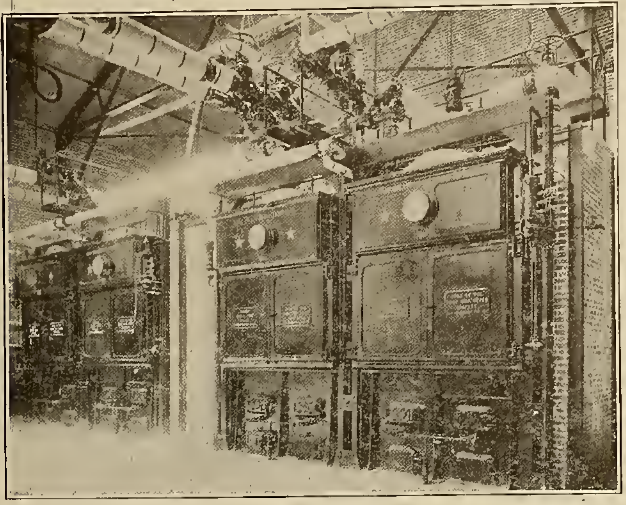
The service conduits feeding these various buildings enter the power house through a tunnel and thence to the various main switchboards through the basement corridor. The tunnel from the basement corridor to the power house is 230 ft. long and the basement corridor is 782 ft. making a total run of 1012 ft.

The necessity of an absolutely reliable source of power in a hospital has been well taken care of by four 500 amp. 125-250 volt generators, each direct connected to steam turbines, with rated capacity of 125 kw. at 2400 r.p.m. working under 150 lb. steam pressure. The boiler plant consists of four banks of Risdon water tube boilers equipped with Foster superheaters and Dahl oil burners. The oil tank has a capacity of 11,400 gallons. In addition to all of the above units, an emergency service switch has been provided on the power house switchboard to throw in any outside source of supply that may be installed.

The power house switchboard consists of 11 panels, namely 5 generator panels (1 panel for a future unit), 1 main lighting and 1 main power panel, 3 lighting feeder and 1 power feeder panels and is 24 ft. in length and 7 ft. 6 in. high. The main busbar switches have a capacity of 8000 amperes.

From the power house switchboard separate light and separate power feeders have been provided to each and every building. These feeders connect to the rear of the power house switchboard through a large pull-in box directly beneath. This box is 2 ft. x 2 ft. 6 in. and 22 ft. long, made of heavy boiler plate and wherein all jumping is done in order to bring out the feeders

in regular rotation to their respective switches. From this point the feeders connect to individual main switchboards in each building, eleven in number and consisting of a blue Vermont marble slab, with a main power and light switch and sub feeder switches for each panel board in the respective building, requiring 152 polished knife switches, ranging from 30 to 400 amperes. There has been installed 6500 ft. of feeder conduit ranging from 1 to 3½ in., for these feeders, using 18,000 ft. of feeder wire ranging from No. 8 stranded wire to 600,000 c.m. cable.



Boiler Room.

Turbo-Generator Room.

From each of the above switchboards individual sub-feeds are run to each panel board located on the various floors. These panel boards are 47 in number and range from 10 circuits to 32 circuits. The total number of panel circuits is 614, ramifying to 4160 light outlets and 61 motor outlets ranging from 1/6 to 35 horsepower.

The total number of feet of conduit used in this installation in size from ½ to 3½ in. is 136,860 ft. In branch circuit work alone 108,600 ft. No. 14 duplex wire is installed and 32,100 ft. of telephone wire.

Particular care has been taken with the telephone systems which are throughout installed in conduit work. Three individual runs are provided to each station, one for public phones, one for private and one for a special house system to be installed later. Ninety-nine stations have been installed with provisions for 120 more.

In addition to the telephone systems, conduits have been installed for a visual doctor's call system with 24 stations, one at each cross corridor of each floor, to call any doctor or interne from the main office. The system will consist of double-faced luminous indicators at each point which will illuminate simultaneously any number or numbers throughout all buildings at one time at all of the 24 stations and will be controlled from the main office in the administration building. A buzzer system has also been installed with buzzers at 24 different points similarly located as the visual system outlets

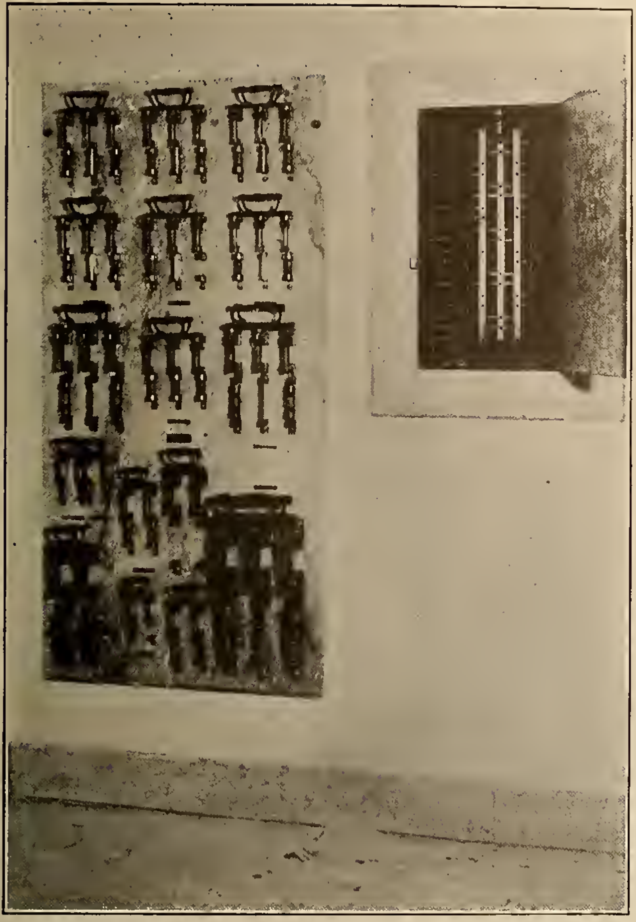
Master Silent Signal Annunciator.

These buzzers can be rung from the main office either all 24 at one time or each building individually and can be used for a program system or in place of the visual calls. The buzzer system is operated from a 6 cell, 40 ampere hour storage battery located in the battery room.

In order to provide means for the patients to call the nurses a silent visual call system has been installed. Over each and every bed a special signal light has been placed and connecting therewith is a call switch at the end of a 6 ft. cord. In addition to this light, a light has been placed over the ward door both inside and outside, another light at the nurses' desk and one in each diet room.

If the patient presses the call button, it automatically locks itself and lights the lamp over the bed, operates a relay which lights the lamp over the doors, at the desk and in the diet room. To further protect the

patient a master annunciator is installed in the main office which indicates the calls not answered in any or all of the wards, thereby indicating to the superintendent whether the calls are attended to. The call switch at the bed requires a key carried by the nurse to reset it for another call, thereby compelling the nurse to



Typical Main Switchboard and Panel Board in Each Building.

go to the bed before any light can be extinguished. Five hundred and twenty-seven silent signal call stations have been provided. This system is operated on 110 volts direct from the lighting mains and will operate on either direct or alternating current.

The time elements have also been fully taken care of by the installation of a complete electric clock system consisting of 78 stations. The clocks are all set flush with the wall and have a 12 in. white marble dial with bronze numerals and hands. These clocks are operated from a four circuit master clock in the superintendent's office. The current for the clocks is provided by 25 cells of storage batteries, which are in duplicate to obviate any interruption in the service. Each bank of cells is capable of operating the clocks for one week. A charging panel with necessary switches, meters no-voltage release and rheostats to charge for the 110 volt circuit has been provided. A separate room has been set aside for this equipment and which has been arranged in a very satisfactory manner.

Semi-indirect lighting is used for the wards with dust-proof covers over the bowls. While the hardware and switch plates are all nickel on account of wear, the fixtures are white enamelled and with plain lines. All ornamentations have been omitted to prevent dust collection. The fixtures in the operating rooms will be adjustable and can be set in any position. In these rooms an additional precaution has been taken by the installation of gas outlets.

Conduits in Tunnel to Main Switchboard.

In the hydro-therapeutic room, an electric cabinet, an electric bath and a galvanic and faradic treatment coil has been provided. All the electrical construction was performed by the Butte Engineering & Electric Company.

CO-OPERATION BETWEEN FOREST SERVICE AND USERS.

To give settlers and other local users a larger voice in national forest administration, Secretary of Agriculture Houston has promulgated a new regulation, providing a means by which the forest service may systematically co-operate with duly organized associations of such users. Any association whose members include a majority of the local residents making use of the national forests may get together and select a committee, to meet with the local forest officers. This committee will be recognized in an advisory capacity in settling questions which may arise between the forest service and the public in the use of the forests.

This regulation is designed to prevent any local feeling that a western user in contact with the national forest administrative system is up against a far-away bureau at Washington, represented on the ground by a forest officer who can do as he chooses and against whose actions it is impossible to make effective protest.

It is the announced policy of the department to favor the greatest good to the greatest number, and the local user over others. With the help of the advisory boards now provided for, many of the problems affecting individuals which the application of such a policy involves can be settled by submitting them to what is practically the organized public sentiment of their own neighbors. On the other hand the organization can initiate questions and bring them to the attention of the forest service, backed by the voice of the majority of those who are dependent upon the forest industries.

HEAVY OIL AS FUEL FOR INTERNAL-COMBUSTION ENGINES.

BY IRVING C. ALLEN.

The many inquiries addressed to the Bureau of Mines regarding the supply of heavy oils and the use of these oils as fuel for steam raising and for internal-combustion engines have made advisable the issue of Technical Paper No. 37 (from which this article is condensed). It presents the result of an extended search in the United States and abroad for some means of more effectively burning the heavy asphaltum oils of the Pacific and Gulf coasts.

On the Pacific and Gulf coasts of the United States, not to consider the increasing output in Mexico, there is produced a great quantity of heavy asphaltum oils. These may be refined and first class products manufactured therefrom. In this refining, as also in the refining of the petroleums from the other oil fields of the United States, there is produced a so-called gas oil, which is that portion of the petroleum distilling between the heavy naphthas or kerosenes and the light spindle oils. It is too heavy for lamp oils or for burning in a gasoline engine, and is too light for lubricants. The United States Geological Survey states that there was produced in 1911 from the California and Gulf coast oil fields 101,381,285 barrels of crude petroleum, valued at $50,942,446. This petroleum on refining would have yielded approximately 5 per cent, or 5,069,064 barrels, of gas oil. From the other oil fields of the United States in 1911 there was produced 119,068,106 barrels of crude petroleum, valued at $83,102,306, of which approximately 3 per cent, or 3,572,043 barrels, was gas oil, making a total of 8,641,107 barrels of gas oil.

This gas oil, as its name implies, can be cracked in hot retorts and an excellent illuminating gas made therefrom, or it may be burned with good results as a fuel under steam boilers.

By being mixed or blended with a small proportion of the low-boiling natural gasolines gas oil can be enlivened, by increasing its volatility and lowering its specific gravity and flash point, and made to burn in explosion engines. Even with the above uses gas oil has been produced in greater quantities than can be efficiently consumed, and its profitable disposal has been a burden on the refiners. In the past few months, however, due to the enormous demand for gasoline, gas oil has been recracked in the stills at the refineries and a part converted into gasoline.

This led the Bureau of Mines to seek more efficient means for its use. The heavy-oil internal-combustion engine—that is, the various modifications of the Diesel type—seemed to open a promising field, and a critical study of these engines abroad and in the United States has developed very encouraging results.

As approximately 0.4 pound of an oil similar to gas oil will produce 1 horsepower-hour when burned in a heavy-oil engine, the total production of gas oil from the petroleum fields for 1911 would alone, without considering the vast resources of coal and wood oils, develop approximately 6,351,213,645 horsepower-hours without in any way interfering with the uses of the other petroleum products now manufactured. This would mean the addition of about 725,000 horsepower running continuously throughout the year.

Use of the Heavy-Oil Engine in the United States.

Diesel developed his engine in the early nineties, and has since then greatly improved it and has made of it a most successful and efficient power producer. At present it is thoroughly dependable and will burn a great variety of oils. But only within the past four or five years, however, has the engine been successfully constructed within the United States. Although the prime requisite in Europe seems to be economy in operation, low first cost seems to be a more important requirement in this country, and at first comparison with the steam engine the Diesel seems to be exceedingly costly. Small imperfections in mechanical construction, up to within a very recent date, seem also to have had their influence upon the non-construction of the engine in the United States. Also, although the general industrial profits within the United States are large, the very abundance of raw materials and the general extravagance in their use seem to have combined against the wide adoption of this engine, in spite of its being so highly efficient and in spite of the fact that it has met with such success abroad.

Although the engines are reliable, lack of experience in handling engines with such high cylinder pressures has raised in some cases an undeserved prejudice against their use. Trouble in starting is usually due to unclean and ill-adjusted valves, and an auxiliary air supply is necessary. The exhaust valves become pitted and must be reground about every three months; but 15 minutes should suffice to replace a worn valve with a new one. Also, more lubricating oil is required than with a steam engine.

Fuel Economy of Heavy-Oil Engine.

In a heavy-oil engine 200 to 250 grams, or approximately 0.4 pound, of oil is consumed in developing 1 horsepower-hour, whereas for a steam engine of the best triple-expansion type, from 1.1 to 1.8 pounds is necessary. This difference in fuel consumption gives an efficiency of the oil engine compared with the steamer of from 0.4 to 1.1 pounds, or a ratio of approximately 1 to 3, or conservatively 10 to 25 in favor of the oil engine.

The efficiency of coal as compared with fuel oil for steaming is variously estimated at 10 to 17, 10 to 15.5, and 10 to 16.1. It may be of interest to note that a turbine engine taking steam from boilers fitted with the best Koerting burners for oil, with accessories complete, built by the Franco Tosi Company, Milan, and installed at the Turin Exposition in 1911, required two and one-half or more times the weight of oil fuel per horsepower than did a Diesel engine built and installed by the same company at the same time and place for purposes of direct comparison, thus giving a ratio of 25 to 10 in favor of the Diesel engine.

Per unit weight, not considering the relative storage capacities needed, the quantity of oil required for burning in an oil engine compares with the quantity

of coal required for steam production as 35 to 10, as shown from the following statement:

FUEL ECONOMY.

Oil storage, 11.5, to coal storage, 10.

Calorific value of oil, 14, to calorific value of coal, 10.

Oil burned in an oil engine, 25, to oil burned for steam production, 10.

One gallon of water at 15 degrees C. weighs 8.3316 pounds.

The average specific gravity of California crude oils is 0.9574 at 15 degrees C.

One barrel (42 gallons) of California crude oil weighs, therefore, 335 pounds, and is equivalent to 1,172.5 pounds, or 0.58625 ton, of coal. From this ratio the cost of either fuel can be calculated from the market quotations.

The quantity of oil required in a heavy-oil engine and its resulting efficiency, estimated within a margin of about 5 per cent, is approximately shown in the table following:

Fuel Consumption and Efficiency of a Heavy Oil Engine.

Load.	Pounds of oil per brake horsepower hour. Pound.	Thermal efficiency (based on brake horsepower hour). Per cent.	Mechanical efficiency. Per cent.
Fuel load	0.472	30	74
¾ load	.500	..	65
½ load	.562	26	58
¼ load	.748	..	47

When one considers that in good steam boiler and engine units the ordinary thermal efficiency is only 12 to 13 per cent, the advantage of the heavy-oil engine, for marine work particularly, is apparent.

The distribution of the total heating units from an oil when used in a Diesel engine is about as follows:

Heat Balance of the Diesel Engine.

	Per cent.
Total heating value of fuel	100.0
Indicated horsepower	44.2
Brake horsepower	32.7
Friction of air, water, and oil pumps	11.3
Cooling water	33.3
Exhaust gases	22.7

Combustion of the Fuel.

In selecting a fuel for this engine its composition as affecting combustion is most important. For proper combustion the fuel should be mobile and volatile, clean, and free from water, solid particles, and grit. In general the specific gravity of an oil rises directly as the vapor density. The boiling point and the amount of air necessary for combustion vary inversely with the volatility, and the greater the volatility of the fuel the better the ignition and combustion. The calorific value of bituminous tars in general is lower than that of lignite tars or petroleum products. Petroleum benzines require approximately 40 volumes of air, whereas the heavy petroleum products require approximately 100 volumes of air for complete combustion.

Petroleums, gas oils, and lignite tar oils readily lend themselves to gasification and they leave practically no residue, giving them peculiar value in an oil engine. Anthracene and creosote oils gasify fairly well. An oil, to give best results in a heavy-oil engine, should on heating show a tendency to volatilize suddenly at some given temperature and not to give off vapors regularly and uniformly, that is, distill with the rise in temperature. To this tendency to sudden volatilization or explosion, in contradistinction to regular volatilization or uniform distillation, is due the value as a fuel in the heavy-oil engine (unlike the explosion engine fitted with carburetor and igniter where the time of combustion is so short).

The following oils and mixtures of them have been used successfully in heavy-oil engines, provided they were mobile, free from free carbon, grit, and water, and were low in sulphur:

Peroleum products: Gasoline; lamp oils of all kinds; naphthas; gas oils; fuel-oil distillates; "masut" or residues from the crude oils of Russia; and crudes, if mobile.

"Steinkohle" oil products: Heavy oils; anthracene oils; and tar oils.

Bituminous oils: Retort oils of all kinds.

Lignite oils: Benzene; solar oils; paraffin distillates; and creosote oils.

Turf oils: Creosote oils.

Shale oils.

Vegetable oils: Peanut oil; cocoanut oil; castor-bean oil; cottonseed oil; and palm-seed oil.

Animal oils.

Alcohols.

Wood oils: Creosotes.

Any fuel that will flow freely can be burned in a heavy-oil engine. Though this in a measure is true, heavy tarry oils, if not kept perfectly fluid by heating, will cool and tend to clog the pipes and valves. It is advisable, therefore, to first subject the tarry oils to a distillation, distilling over everything up to the tar residues or even to the cokes, and to use this distillate for fuel without further treatment. The cost of distillation will be outweighed by the more satisfactory running of the engine.

When the fuel oil is heavy and contains little volatile material, it is advisable to inject alongside the main fuel spray, by means of an auxiliary spray, a small quantity of an oil having a relatively low flash point, such as a heavy benzine or a "gas oil." This ignition oil, igniting at the proper moment, will in turn ignite the more sluggish fuel oil, and proper ignition will thereby be insured. The ignition oil may also be injected within the fuel valve or first blended with the fuel itself in the storage tank.

Conclusion.

The heavy-oil engine can not yet be considered as fully developed and much work remains to be done in perfecting it. With the present imperfect knowledge of what the engine is capable of doing, and of what particular oils can be successfully used in it, one can not speak conclusively as to definite specifications for fuels, and for lubricants, and those outlined above must be considered, therefore, as tentative.

But the fact that petroleums containing as high as 20 per cent asphaltum as well as oils from tars have been successfully used is most encouraging. The future of the engine, and also a more efficient utilization for asphaltum liquid fuels and coal and wood by-product liquid fuels is assured.

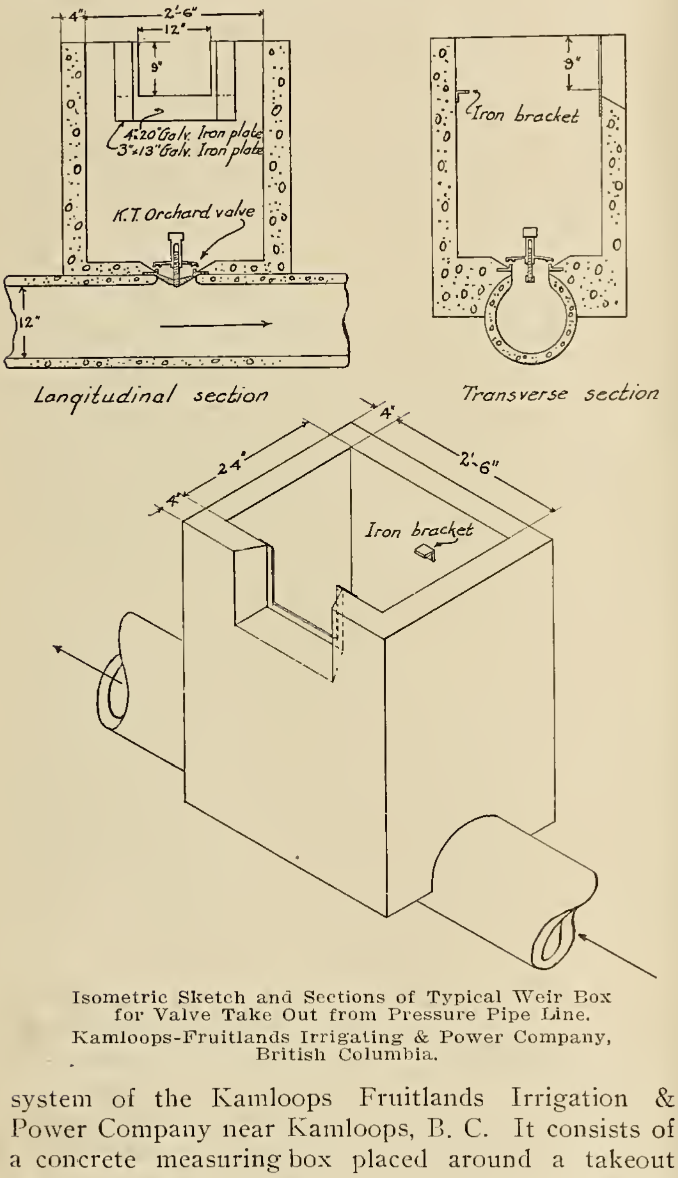
ELECTRICAL PUMPING AND IRRIGATION

MEASURING DEVICES.

BY B. A. ETCHEVERRY.

Weir Box and Take out From Pipe Line Under Pressure.

Where the water is carried in a pipe line under pressure the water must be delivered through a valve connected to the pipe. A good type of measuring weir box will consist of a rectangular box placed around the valve, with the measuring board placed at the top of one side of the box. The accompanying drawing shows a form of measuring box very similar to those installed on the cement pipe lines of the irrigation



Isometric Sketch and Sections of Typical Weir Box for Valve Take Out from Pressure Pipe Line.
Kamloops-Fruitlands Irrigating & Power Company, British Columbia.

system of the Kamloops Fruitlands Irrigation & Power Company near Kamloops, B. C. It consists of a concrete measuring box placed around a takeout valve cemented to the pipe line. The valve is obtained from the Kellar & Thomason Manufacturing Company of Los Angeles. It is cemented over a hole cut in the cement pipe and regulates the flow in the box. The box is rectangular, made of four concrete walls 4 in. thick, reinforced with strands of barb wire 6 in. apart. A notch is formed in one side wall and a rectangular weir plate made of galvanized iron strips is cemented in. To measure the depth of water above the crest a metal bracket is cemented in the wall opposite the weir opening and at the same level as the weir crest. The water which passes over the crest discharges into the irrigator's flume or ditch. In case of an earthen ditch it is necessary to prevent erosion or washing away of the soil by the falling water, by providing a receiving box or basin or by protecting the soil with paving. Some irrigation companies in Southern California simplify the construction of the weir boxes by using in place of the rectangular box, two or more sections of large size cement pipe placed vertically around the valve. The weir is formed by cementing a weir plate in a notch cut in the upper part of the pipe.

Miners' Inch Board or Box.

The method of measurement associated with the miners' inch unit has many advantages.

1st. The irrigator can tell at a glance how much water is being delivered. It requires no computation or reference to tables.

2d. It is well adapted to measuring small volumes of water, and is fairly accurate if properly carried out.

3d. The flow through a miners' inch board is affected much less by a change in water level than the flow over weir. A 10 per cent rise of water level will increase the flow over weir by 15 per cent while with a miners' inch board the flow is increased only 5 per cent.

The disadvantages are:

1st. The device is not adaptable to large volumes of water because the required length of the orifice may be too great.

2d. Unless the conditions necessary for accurate measurements are carried out, the results obtained may be very inaccurate.

A miners' inch board consists of a board in which one or more orifices have been made through which the water is measured by maintaining a constant head over the center of the orifice. The head usually ranges from about a minimum of 4 in. to a maximum of 8 in. The California miners' inch as used in Southern California requires about a 4 in. head and gives about 1/50 of a second foot. The British Columbia miners' inch requires about an 8 in. head and gives 1-35.6 second foot. When more than one orifice is used they are made of different sizes so that different volumes of water may be measured. When only one orifice is made it is usually a long orifice made adjustable and regulated with a slide. To obtain accurate results the jet coming through the orifice must touch only the upstream edges and clear the downstream edges, so as to discharge freely into the air. With a board 1 in. thick if the corners are sharp, it is not necessary to bevel the edges or use thin metal plates. To measure a large volume of water the length of the orifice, if the orifice is only 1 in. high, will be excessive. To

avoid this the orifice is frequently made, 2, 3, 4 or even 5 in. high. This will affect the accuracy, especially when the required head on the center of the opening is small. A miners' inch board may be fitted in a box constructed about in the same manner as for a weir board. To obtain accurate results at least 6 in. must be allowed on the upstream side of the board from the lower edge of the orifice to the bottom of the ditch or floor of the box into which the board is placed, and at least 2 to 4 in. from the ends of the orifice to the sides of the ditch or box. On the downstream side the jet should discharge freely into the air.

To obtain a constant head on the orifice a fairly successful device is known as the Foote measuring box. It consists of a section of flume divided into two compartments by an overflow crest wall placed in between and parallel with the sides of the flume section. The compartment which is on the same line and forms part of the supply ditch is open at both ends and the flow can be checked or regulated by flashboards. The other compartment forms the box from which the water passes through the orifice in the side wall. The flow into this box is regulated by a gate and the excess passes over the crest of the overflow wall back into the canal. The crest of the overflow should be above the center of the opening a height equal to the required head and it must be of sufficient length to dispose of the excess without increasing the depth of water to a great extent.

The use of an overflow to regulate the head on the opening is applied in Southern California to miners' inch boxes for takeouts from pipe lines under no pressure much in the same manner as the Foote measuring box; the form of box is described further in connection with cement pipe systems.

Submerged Orifice.

A submerged orifice consists of a channel or flume section in which are placed one or more gates and the orifices are formed by raising the gates. The discharge is measured by obtaining the size of the opening and difference in elevation of the water level upstream and downstream. As generally constructed the floor forms the lower edge of the orifice. This suppresses the contraction on the bottom. When more than one gate is used, unless the openings are sufficiently separated, they will affect each other and will tend to suppress contraction on the sides. For these reasons the formula for submerged orifice with full contractions will not give accurate results and must be modified. Experiments made in the Imperial Valley give approximately the following equation:

$$Q = .7 \ A\sqrt{2gh}.$$

Where h = difference in elevation in water surfaces: A = total area of opening.

The advantages of submerged orifices are that they can be used for water carrying silt and do not require a large loss in velocity head.

Special Measuring Devices.

The Grant Michell meter is known as the Australian meter, having originated in that country. It consists of a four-bladed fan fastened to the lower end of a vertical spindle which transmits the revolution of the fan to a gear box at the upper end. This mechanism is suspended from a cast iron bracket over a wrought iron orifice plate placed below the canal bed and built or bolted down into the downstream part of a box divided into two parts by a baffle wall open at the bottom and extending above the water surface. The water passes down through the opening and imparts a rotary motion to the fan. The gear box forms the recording device which consists of a series of dials giving a continuous record in acre inches and fractions or in cubic feet. The fan spindle and gear box are removable and portable and can be used for several boxes. The discharge depends on the size of the orifice plate and on the difference in elevation in the water surface upstream and downstream. The size of the meters is generally based on a 3 in. loss of head, but may be designed for less. The orifices range from 9 to 40 in. in diameter and are used for discharge of 1 to 20 cu. ft. per second. The serious objection to this meter is the high cost ranging from $60 for the smaller one to $250 for the larger one. These prices are the catalogue prices of Geo. Kent, Ltd., 199-204 High Holborn street, London.

Automatic registers give a continuous record of the quantity of water, whereas the volume of water delivered over weir or the discharge of a ditch flume or creek by measurements at a rating station or rating flume will vary with the fluctuations in the water level. These registers are of different types. They can, however, be classified in two classes. They all consist of a clock, a float and a cylinder or drum to which is fastened a sheet of paper on which the depth of water at different times is recorded by a pencil or pen.

With one class of register the cylinder is placed vertically and is rotated by a clock which gives it one revolution a week. The pencil is connected to the float which is placed in a well or box built on the side of the weir box or rating flume and connected with the water through an orifice. The fluctuations in water level cause a rise and fall of the float and a corresponding movement of the pencil which is recorded on the sheet placed on the drum.

The other class of register differs from the first class in that the cylinder is placed horizontally and is rotated by the float instead of by the clock and the pencil is carried parallel with the cylinder by connections with the clock. In each case the record obtained is the result of two motions which give an irregular line showing the fluctuations and giving the depth of water at any time. The various types of registers are illustrated and described in Bulletin 86, part 1, of the Office of Experiment Stations of the U. S. Department of Agriculture, Washington, D. C.

The cost of registers ranges from about $40 upwards and for that reason they are seldom used for the measurement of water delivered to irrigators. They are, however, of much value in the operation of a system when installed at the head of laterals.

WESTERN DISTRIBUTING LINE PRACTICE.

[The subject matter subjoined relates especially to the Western states, and particularly to the Pacific Coast, being the gist of a report by P. M. Downing, Markham Cheever, J. A. Lighthipe and L. N. Peart to the National Electric Light Association. Distributing lines are distinguished from trunk and transmission lines only in that the latter are used to connect important generating and distributing systems.—Editor.]

The past few years have brought about many changes in the method of transmitting and distributing electrical energy for power and lighting purposes. Voltages which a short time ago were not considered commercial possibilities are today being used not only on long transmission lines, but very generally for distributing purposes. It has not been long since 40,000 or 50,000 volts were considered the maximum at which a line could be operated safely and economically.

The continually increasing demand for electric power has made necessary the use of voltages as high as 100,000 or 150,000 for transmission purposes, leaving the lower voltage lines which were once used as transmission circuits to be used almost exclusively for distribution purposes.

Another condition contributing to the use of the higher voltages is that the rates are being continually reduced, while the territory served is increasing. This condition has forced operating companies to adopt a construction the cost of which will be the minimum consistent with good service. Today there are a large number of companies operating general distributing systems in rural districts at voltages as high as 22,000.

Voltages higher than this can seldom be used to advantage except in the case of large consumers, owing to the high transformer cost. Where there are a large number of such customers whose requirements range from 1 to 15 hp., with only an occasional greater demand, a lower voltage can be used to advantage. Fifteen thousand and 11,000 volts have been adopted by a large number of companies, although 6600 volts are also being used in many instances. Forty-one hundred volts, being 2300 volts star connected, is perhaps the most satisfactory voltage for use in districts where the load is not great enough to make the copper cost prohibitive.

In deciding on the voltage to be used in any new territory, local conditions and the probable future demands for power will, to a very great extent, be the determining factor. The standard, and perhaps the best and most generally used voltage for cities and suburban territories is 4000, i.e., 2300 volts, star connected. Transformers of this voltage can be had at a minimum cost.

In the congested business centers of the larger cities direct current can sometimes be used to advantage. The only features, however, which recommend a direct current distribution over the alternating current are: (1) The more satisfactory operation of direct current motors, and (2) the ability to use storage batteries to improve the regulation and guard against interruptions to service. These advantages, however, are not so apparent now as they once were. The improvements which have been made in the operating characteristics of alternating current motors leave but little to be said in favor of the direct current apparatus. As a guarantee against interruptions to service, the modern steam turbine is much more reliable than the reciprocating engine. Many of the companies receiving energy from hydroelectric sources now realize the necessity of maintaining a steam turbine station for both reserve and regulating purposes.

Opinion as to the best connection to be used on transformers seems to be about evenly divided between the delta and the star. On lines up to 15,000, which is about the limiting voltage from which small services can be supplied economically, the star connection with grounded neutral seems preferable.

If a single-phase service is required, the neutral can, to advantage, be run out from the station to carry the unbalance. In the event of single-phase service being required in an isolated section only of the system at a considerable distance from the station, and where the expense of carrying the neutral the entire distance from the station would not be justified, an artificial neutral may be established locally. By keeping the load in the district reasonably well balanced between the three phases, only the unbalance would be carried through the ground. From an operating point of view, there is no objection to carrying this unbalance through the ground. Objection is, however, sometimes raised to this method of operating by the telephone, telegraph and signal companies on account of inductive interferences with other circuits in the immediate vicinity of the power lines.

The type of construction used on distributing lines has not changed to any great extent during the past few years. For the lower voltage circuits, i.e., those operating at not more than 22,000 volts, the single flat-arm construction has been most used. Where it is desired to carry two circuits on the same line of poles, either of two constructions can be used: (1) The conductors of the two circuits may be supported on two arms to form two triangles on opposite sides of the pole; or, (2) the two conductors may be placed in the same plane either vertically or horizontally. A safe and thoroughly substantial construction for the very high voltage lines can be had by supporting the two circuits on suspension insulators in vertical planes on the opposite sides of the pole.

For voltages up to 22,000 the pin type insulator has proved very satisfactory. From this voltage up to 60,000, both the pin and suspension types have been used. For voltages above 60,000 the suspension type is used almost exclusively. The objection to the use of suspension type insulators on voltages between 22,000 and 60,000 is the greater first cost. This, however, should not always be the determining factor in deciding the construction to be used on a line, especially if the service is important and is to be supplied by a single circuit. On the Pacific Coast and particularly in the sections where the salt fogs are prevalent, the suspension type of insulator is to be recommended. The reason for this is that it has fewer air pockets in which dust and dirt can collect. During the months from June to November there is little if any rainfall, with the result that considerable

dirt accumulates on the surface and under the petticoats of the insulator. The salt fogs or rain coming into contact with this dirt form a leakage path which is very apt to cause trouble. The fogs are worse than the rain, as practically the entire surface of the insulator will be wetted without washing off any of the dirt, whereas with the rain the top and outer portions of the petticoat are washed clean and the inner parts are left fairly dry.

The only way to overcome this trouble is to clean the insulators by wiping them. In some sections this dirt and salt fog condition is so bad that even the telephone and telegraph circuits become at times inoperative until the insulators are cleaned.

A large portion of the suburban business consists of reclamation, irrigation and small domestic motors. To give service of this kind requires a comparatively large mileage of lines per horsepower of connected load. To keep the investment down to a point where the business to be had would justify the first cost of the installation, it has been necessary to construct lines at a minimum cost. A very satisfactory construction consists of 30 or 35 ft., round, white cedar poles, spaced 15 per mile, with the three conductors carried in a horizontal plane at the top of the pole.

Very often, where the load is small and the voltage regulation is not of too great importance, a considerable saving can be made by the use of iron wire, instead of copper or aluminum. This has been found to give equally as good service as the more expensive conductors, providing, of course, it is not overloaded. Outside of cities and communities, where the use of insulated wire is required by ordinance, it is the almost universal practice to use bare conductors. Service wires leading into buildings are always insulated.

Of late years there has been a strong and growing tendency for legislative and other governing bodies to regulate line construction details. A number of states have done this by direct legislative enactment, while others have vested that authority in commissions having control of public utility affairs.

In California where the State Railroad Commission has control of all public utilities, the specifications for overhead crossings for electric light and power lines over railroads, street railroads, telephone and telegraph lines, etc., as adopted by the National Electric Light Association, have been accepted for crossings of lines carrying voltages of 15,000 and over. A compliance with these specifications will, in some respects, improve the crossing construction, but it is believed by many engineers that certain changes could be made that would materially lessen the first cost of the crossing without in any way impairing its efficiency.

Line extension estimates are generally made on the supposition that the gross revenue for the first three years will equal the cost of the investment. In some instances, however, when the extension is into new territory, where there is a probability of other business being developed, or where the demand is large and is to be supplied on long-term contracts, the investment can be made on a more liberal basis. In other words, the extension might be made on the basis of the gross revenue for five or an even greater number of years equalling the investment. Sometimes the customer is required to advance a portion or all of the first cost of the extension and have it rebated to him: (1) within a certain fixed period of time; or (2) on the basis of a certain percentage of his monthly bill to be refunded.

Arrangements of this kind are oftentimes very satisfactory when made with customers whose requirements will ultimately be large, and who, perhaps, should have the benefit of the lower rate for their present small demands. The percentage of the power bills rebated averages from 20 to 25 per cent.

ELECTRICITY FOR IRRIGATION.

The San Joaquin Light & Power Corporation has recently extended its transmission lines to serve the rich agricultural and oil districts of the coast counties of California. In this territory electric pumping for irrigation is comparatively new. Alfalfa as an adjunct to range feeding of cattle is attracting much attention and many new installations are being made.

The Golden Eagle Creamery, near Santa Maria, have harnessed two wells which are used for irrigating alfalfa at two levels. Water is put onto the tracts by means of flumes, one above the other. The first lift is 12 ft. into the lower flume to irrigate between 75 and 100 acres, while the upper flume is a lift of 27 ft. and irrigates an additional 100 acres. Formerly the wells were pumped by steam and a windmill was also used, but the cost was so high that the plant had to be shut down to await the arrival of electricity. A 30 h.p. motor has since taken the place of the 70 h.p. steam plant. The big creamery operated on the ranch is electrified throughout and a 7½ h.p. motor gives sufficient power. A 3 h.p. motor has also been installed for domestic purposes and general farm use.

An electrical research laboratory has been established at the Massachusetts Institute of Technology under the direction of Dr. Harold Pender. A grant of $10,000 a year for five years has been made by the American Telephone & Telegraph Company, another anonymous donor having pledged $5000 yearly toward the expenses of an investigation of the distance to which a street car passenger can be carried at reasonable profit for a five-cent fare. The New Haven roads have also contributed $2000 to be used in studying freight handling. During this summer investigations are being conducted on the phase relations of harmonics in sound waves as affecting the clearness of telephonic speech and also on the "skin effect" in alternating current transmission.

Electric purification of swimming pools is said to be a success in England. The bacterial contamination from hundreds of bathers in fresh water pools is neutralized by the addition of electrolyzed sea-water. By adding 30 gallons of the sterilized water, costing thirty cents, to an 85,000 gallon pool at three-day intervals the water is kept clear and free from noxious bacteria.

AN IMPROVED INVENTORY SYSTEM.

BY E. I. TITLOW.

An inventory of a public utility property contains information of direct value to the construction and operation departments of a company if put into suitable shape. An intelligent compilation and management of data collected by field parties greatly enhances its value to the company as it can be made to serve many purposes besides a mere physical valuation.

A general map of a transmission line from power plant to substation can be made to show many facts. By supplying field parties with black and white prints or slightly bleached blue prints mounted in portable book form, many notes and sketches can be made in the field and subsequently used in the office.

Pole Lines.

Poles should be numbered and the field party of linemen, chainmen and draftsmen should be required to note all places where the size of wire changes, checking with a lineman's calipers. Conditions of covering, size of pole top, and make of transformers should also be reported, the draftsmen making a sketch of the pole top, the party not leaving the pole until all data is gathered and recorded. Some such table could well be followed:

Pole number (to be recorded on the map, showing lengths and sags).

Height and size of top.

Condition as to paint, gains and butt decayed and split.

Trim as shown on the pole top sketch, showing also circuit numbers, transformers, but not services, which may be better taken by another party who will also gather the meter information.

As meters and transformers are often moved about they should each be given a card showing their number (serial) and location on a certain date with blank space left for movements. Then there should follow all data, including date of tests.

A transformer card should be made out similarly, showing in addition the maker's name, the rating and all primary and secondry taps, also dates of change of oil. Another party had better follow for arc lamp and company telephone.

Substation Buildings.

A distinct gain in clearness may be made in the inventory sheet by giving the apparent percentage of the present value of building and equipment in terms of replacement value when equipped with new and up-to-date apparatus. It should be stated that with a modern system the station might be omitted altogether, if such were the case. Such an opinion or general statement would serve as a heading or synopsis of the whole situation at this place, and these headings could be used as the basis of a quick, approximate valuation of the system, and would save clouding the inventory with a mass of figures and data without break or headings. It is a well known fact that these off-hand opinions have proven remarkably correct.

Following the off-hand opinion, the quantities for the building may be kept separate from the equipment. Here the labor unit prices for construction should be settled in the field, as many questions regarding distances, cartage and kinds of excavation may be decided by the older members of the operating crew better than they can be later on in the office.

Large openings in thick masonry walls should be noted in the field with the qualification that the work around them was ordinary, when about two-thirds of their size may be deducted, smaller openings not being deducted at all. Notes as to obsolescence of building should be made here. Excessive care in sizes of foundations is time wasted when engineers cannot agree on labor prices.

Equipment.

No graver mistake can be made in the field on important apparatus than to omit name-plate data in the hope of hurrying the field work. The writer has seen as many as five men go over the same apparatus with all the labor of unboxing and reboxing, each man looking for information along a different line. In fact, throughout the whole inventory, time will usually be saved and questions forestalled by a thorough exposition of condition and data on apparatus. In addition the company will then have office records which will be of great value when properly indexed. A wide-awake company will take advantage of the handling of stock to enlarge the stock shelves and give the inventory party a chance to put like material together and in an accessible form. This will enable the construction engineer to have stock shipped out promptly and correctly without ordering new material, as he would undoubtedly prefer, knowing that he will get, in the latter case, exactly what he wants and without sending his foreman to get out the stock for shipment.

Underground Material.

Profiles of the streets are necessary in order to show the depths and kind of ground excavated. Depths may be taken at the street corner as sufficient and in the case of electric conduits the manholes will show the exact condition. In many cases pipes were originally laid in early days through hilly streets which have since been graded so that the replacement excavation would be much less than the original excavation. Such profiles are necessarily made to a larger scale vertically than horizontally and show pipes which are round as vertically elongated (ellipses instead of circles).

Cross sections of the streets traversed by the company's mains will usually be too expensive to make and their only purpose would be to show how crowded the street was when extensions are to be made which work cannot well be made part of an inventory.

Maps should show the length between Tee points of each size of pipe and the accompanying profile show the depths. It is then always easy to summarize the length and depths of each size of pipe.

Conduits.

The same procedure will best show the number of ducts and where they change and the profile will indicate the material of the ducts, whether concreted or not, and the kind of ground, as well as referring to the manhole drawings which the company will have on file.

On these maps, notes can be made of the condition of underground pipes and electric conductors, for which some measurements of insulation resistance must be made to give an idea of whether the cables have been "cooked" by excessive loads in the past.

Manholes and Subway Type Transformers.

Flooding marks can usually be detected and the kind and condition of the manhole sump should be noted, as in a sandy valley the sump should contain a return check against flooding from the water in the soil. These factors should be noted for obsolescence, as well as the strength of the covers and supports for carrying the increasing weight of traffic.

Plan of Reports.

As on the overhead work, the clearest results will be obtained and possible questions anticipated by platting on a map the mains and transformers first by one party and leaving the services to a second party who should wait until they receive the maps and profiles from the first party, which can carry these along when getting the services. Their work will thus be in the nature of a check on the first party.

Determination of Unit Prices for Material and Labor.

A system should early be adopted and carried to a somewhat elaborate scale by properly cataloguing and indexing so that all clerks and questioners may find it of ready access.

Tables of all probable sizes of poles, cross arms, pins, insulators and clamps, bolts, steps, braces, anchors, strain-bobs and guy wires, should be made up in advance and their prices obtained by the office while the field party is marking them on the maps.

Wire tables for copper wire should show the deterioration of the insulation between new and bare as follows:

New—100 per cent for all sizes.

Good—probably 98 per cent in the larger sizes to 90 per cent in the smaller sizes.

If frayed so as to defeat the purpose of weather proofing (namely to offer a covering from which a lineman might have some protection when standing on a dry pole and from bare telephone wires falling across the line, as well as from wire of the same polarity but of different circuits swinging together in a high wind) it may well be given a value of 65 per cent in the larger sizes to 50 per cent in the smaller sizes (which is practically bare wire value).

This assumes that when the insulation becomes frayed, it must be removed to storage until it can be strung in some district where bare wire is allowable.

Tables for aluminum wire will take into account the fact that the scrap value is very much less than in the case of copper due to the soft metal suffering more damage in handling than copper.

Transformers.

As stated above, transformers are moved about and should be tabulated each on its own card with location on that date. The company's contract with the manufacturer will give prices new and deterioration should be only slight if the oil has been changed often enough. An inspection should show this from the formation of sludge around the conductor. Tables of unit cost of excavation in the various soils reported by the field parties should show excavation with and without backfill; in the latter case, allowance being made for a certain haul to dump. As this haul varies the figures cannot always be checked by questioners.

Tables of depositing concrete with both earth and wooden forms in small and large masses can be agreed upon in the office and freight rates looked up to the points where the field parties are getting the quantities.

Tables of steel work costs both in light and heavy sections can also be agreed upon and freight rates on long members looked up.

Brick work tables for the towns encountered will take into account the local wage for brick layers and hod carriers as well as freight from the nearest brick yard.

Probably only a few other building material tables should be made as the kinds are usually very numerous.

Piping and valve tables are a necessity and the field party should return with full information as to brass or iron body valves outside or inside screw, and gate or globe.

Steam pipe flange can be made up in advance from a study of the kinds of joints in the power house. Large pieces of machinery are usually matters of permanent record in the offices of the local agents and the only difficulty is obsolescence. To determine this latter point, it is only fair to adhere to the policy of the company, as some companies have found by bitter experience that a conservative policy will interrupt their service less than one of continual change.

Summary.

The most important points to be watched for are that the records should be left in a usable shape; for instance, a civil engineer should not be given the task of cataloguing the electric machinery; similarly a surveyor should take all distances and levels; and the drafting office should be allowed ample time to get all maps complete and up-to-date. One of the strongest points I would make is that these maps and profiles should take the place of the tabular form of notes; for instance, a set of symbols can be prepared which may be written alongside of each pole on the map, thus indicating in a concise manner the height of pole, number of cross arms, and kind of insulators, as well as the sizes of wire up to the point where they change. This latter is the difficult part on a small scale map and it is really foolish to try to save paper and get the figures so small that they cannot be read in the dirt of the fields.

In addition, if the company has not a diagram of their circuit arrangement, this is the time to make one of a large scale and put alongside of each line a sketch of the pole trim turned in by the field party. Such a sketch should be made for each type of pole, showing the number of circuits, pins, insulators, etc. In no other may can the data obtained be shown so clearly as on these maps and diagrams. They are in addition more likely to be kept up to date after the valuation engineers have departed.

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CONTENTS

Municipal Railways at San Francisco

Municipal ownership of various public utilities is now engaging the attention of several Western cities. In San Francisco, for example, the voters are soon to pass upon a bond issue of three and a half million dollars to construct several competitive municipal lines. The campaign "for and against" is typical of that which has been waged in each of the other Pacific Coast cities and which undoubtedly will continue to be waged until the millenium arrives, when this beautiful ideal will become a practical reality. A brief analysis of the situation is instructive.

The arguments in favor of municipal operation are founded upon the inadequate service of the United Railroads, the private corporation, and the adduced success of the Geary Street Railway, the municipal line. The opposing contention is based upon the dangers of new bond issues and the alleged failure of the Geary street line.

As to past inadequacy of service no question can be raised, though there are certain extenuating circumstances. Chief among these is the prohibitive restrictions which the city has imposed upon extensions. No matter how good may have been the intentions of the company, new capital cannot be raised because of the limitations of its earning power to a short franchise term.

The Geary street line has been operated for such a short time that a determination of its success or failure cannot yet be made. Conflicting figures are presented by either faction to prove their respective contentions, one making no allowance for general expenses, taxes, maintenance or sinking fund, thus showing an apparent profit, whereas the other claims an equal loss when these items are included. Such debasement of the public press is one of the most degrading exhibitions of private greed in the annals of journalism. Neither side is fair and both are trying to create prejudice. Under able management and loyal patronage the new road from the ferry to the ocean beach should show good earnings.

The real question at issue is whether it is for the greatest good of the city to build competing municipal lines. Instead of bickering over bitter differences of opinion about municipal ownership would it not be better for both city and company to co-operate in providing the facilities of which the city is so sadly in need? Far more can be accomplished through co-operation than by competition. Co-operation requires mutual concession and is impossible where politically-bred prejudice exists.

The intelligent investor recognizes the benefits of municipal ownership under private operation, the conservative citizen admits the reasonableness of fair return to capital, but the corrupt politician confounds these beliefs and tries to exact tribute from the investor and force political operation of public utilities upon the citizen. It is only necessary for the two sides to get together without bias and agree upon the greatest good for the greatest number.

Municipal operation of any utility discourages private investment in other utilities and thus retards the natural growth of a city. Furthermore it reduces

the general wage and the number of wage earners, which is primarily dependent upon the investment of capital in the city. Though a labor union may set an artificial wage standard for the municipal employe, all other wage-earners are injured when private capital is discouraged as previously demonstrated in this journal by F. K. Blue. Competition between municipal and private operation of public utilities is destructive —co-operation is constructive.

The benefits of harmony are exemplified by New York City where the municipality and the corporations are building the subways together. Of the $337,000,000 which the new city-owned subways will cost, the city will supply $171,000,000 and the two street railway companies the remainder with the assurance that their investment will be protected.

Chicago, also, after many years of bitter and costly experience, has adopted a plan of resettlement of differences between the corporation and municipality which provides for city profit-sharing in traction earnings and ultimate municipal ownership with fair interest and reasonable assurance to the investor. Municipal control is secured by a board of supervising engineers. At any time the city has the right to purchase the property, as all franchises are indeterminate.

The results in these cities have been brought about by a policy of conciliation. They are based upon the fact that a street railway, unlike a mine, is a continuing investment. It must continue operation irrespective of ownership; operation to extinction is out of the question. Other cities would do well to profit by their experience.

These suggestions are new only in their manner of presentation. They embody much from the report of Mr. Bion J. Arnold. On the basis that "advice is worth what it costs" it certainly behooves San Francisco to follow them. How much better is his suggestion of a regulated monopoly, where the city shares in the profits but is relieved from the responsibilities of operation, than the proposal to tax the earnings of a private company for the construction of a competing municipal railway! His investigation shows that 72 miles of single track should be constructed at once. Why cannot the city and the corporation do this jointly? How long shall prejudice retard the city's growth?

It is as much the duty of the public authorities to provide proper transportation facilities as to build schools or parks. Cheap and rapid transit improves the morals and the health of the people by permitting them to live amid better surroundings. As a reasonable return could not be earned on the investment of private capital in building the subways, New York lent a part of its credit in paying for their construction. Already the increased taxable valuation of outlying reality has more than justified the expense. Since the first subways were built the assessed valuation of the Bronx has nearly trebled, the annual cost of new buildings has increased five-fold and the density of population in the over-crowded districts greatly decreased. Adequate transportation is the first step in the enlargement of any city. Transit facilities must precede settlement.

Respecting the Expert

The Oregon Society of Engineers is trying to have a technical man placed upon the civil service commission at Portland. Engineers have been conspicuous by their absence on many of these boards as well as upon the various public service commissions through out the country. In a paper presented at the annual meeting of the American Institute of Electrical Engineers, Dr. William McClellan suggested the formation of a general engineering society, one of whose functions would be promoting engineering participation in national and civic matters. Lack of unity among the engineers is largely responsible for the low standing that the engineer occupies among the learned professions but far more fundamental is the prevalent lack of respect for expert opinion.

Indeed, so eminent an authority as Hugo Munsterberg, the psychologist, has ascribed this lack of respect for the expert as the primary cause for foolish investments. It is characteristic of the American citizen to think that his opinion on any subject is as good as any one's. Amateur authorities prescribe for bodily ailments as readily as for political disorders. They consider their opinions as to the merits of an investment or the need of an engineering improvement as reliable as that of a banker or an engineer. This so-called independence, together with their carelessness, credulity and unreasonableness, make them the victims of the unscrupulous.

Such being the facts it becomes the obvious duty of the well informed to urge the people at large to recognize the value of expert opinion. Some one has said that it takes ten years to popularize a scientific truth through the ordinary channels of popular education. Popular skepticism, born of ignorance, is one of the most powerful brakes upon the wheels of progress.

But the age of the expert in public life has finally begun. Civil service in the many Federal bureaus has superseded political patronage and the influence of the engineer and the expert in every practical field is destined to control the American life as the ineffectiveness of amateur methods is demonstrated.

A New Lamp

Announcement is made of the development of a new incandescent lamp requiring but one-half watt per candle. The great innovation is the use of an inert gas, such as nitrogen, instead of a vacuum in the lamp, together with a specially shaped tungsten filament. The improvement has been made by the research laboratory of the General Electric Company and is a strong argument in favor of such research work. The first applications will be in units of large candle-power for out-door illumination.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

George Boring, sales manager, Portland branch Pacific States Electric Company, is in Seattle, for a few days.

C. H. Alexander, manager Butte, Montana, office General Electric Company, is spending his vacation in Seattle.

C. E. Spaulding of the General Electric Company, Los Angeles, spent the latter part of the week in San Francisco.

L. Heyneman, manager of the Pacific Coast branch Goldschmidt Thermit Company, has been at Los Angeles this week.

H. E. Sanderson, Pacific Coast manager for the Bryant Electric Company, is making a trip throughout the Pacific Northwest.

Harry T. Hays of the Mt. Whitney Light & Power Company, Visalia, was a visitor to San Francisco the first part of the week.

Alexander Rosborough, vice-president and general manager California-Oregon Power Company, San Francisco, was in Seattle, recently.

H. W. Reynolds, of Chas. C. Moore & Company's San Francisco office, returned this week from a two weeks' vacation in Sonoma county.

I. Irvadare, president of the Nippon Electric Company, Tokyo, arrived Wednesday from New York, leaving San Francisco on the 26th for home.

F. V. T. Lee, formerly assistant to the president of the Pacific Gas & Electric Company, and now a resident of Vancouver, B. C., is at San Francisco.

R. F. Behan of the Westinghouse Electric & Manufacturing Company, San Francisco, is spending a vacation at Pelican Bay, in the Klamath region.

Harold C. Biglin, Western Electric Company's sales manager at Denver, is spending a vacation in California and is due in San Francisco from Los Angeles, the coming week.

R. F. Monges, local engineer for the General Electric Company at Portland, Ore., has returned to Portland, from San Francisco, where he had been called by the death of his father.

Thos. Collins, sales manager of the Westinghouse Electric & Manufacturing Company, San Francisco, has recovered sufficiently from his recent illness to leave the hospital and make a daily visit to the office.

L. G. Brown of the lamp department, General Electric Company, left Wednesday evening for an extended trip east, during which he will attend the conference of the Sunbeam Lamp specialists at Cleveland, O.

R. M. Alvord of the sales department, General Electric Company, San Francisco, recently returned from a vacation trip, which it now develops has turned out to be a honeymoon trip. Congratulations to Mr. and Mrs. Alvord.

A. E. Griswold, president and general manager of the A. G. Electric & Manufacturing Company, and Mrs. Griswold, are making a trip by automobile from Seattle through San Francisco and Los Angeles to San Diego in the interest of the company's business.

W. S. Handbridge has returned from Chattanooga, Tenn., where he has been attending the National Electrical Contractors' Convention as delegate from the California State Contractors' Association. Mr. Handbridge reports a successful convention and brings the news that the 1915 convention will be held in San Francisco.

W. T. Maddex, assistant general manager of the Utah Light & Railway Company, in charge of the operation of the railway department, has tendered his resignation, effective July 15th. Mr. Maddox was division superintendent of the Pacific Electric Company of Los Angeles, with headquarters at Los Angeles, California, prior to his accepting the position with the Utah Light & Railway Company last November. He is returning to Los Angeles to look after his personal interests there. His broad experience and uniform courtesy and attention to the details of management which make for comfort and safety of travel have made him extremely popular in Salt Lake City.

George W. Manning has been appointed superintendent of railway service for the Utah Light & Railway Company, to fill the vacancy occasioned by the resignation of Mr. W. T. Maddex. Mr. Manning entered the street railway service in Salt Lake City twenty-two years ago as an extra man. For six years he served as motorman and conductor and received his first promotion as inspector in 1897. He has risen steadily through the various grades of service to the position of assistant superintendent, which he occupied at the time of his recent promotion. Mr. Manning has always been popular, both with the employes and with the public, and is receiving countless congratulations on his good fortune.

OBITUARY.

Mr. C. B. Smith and wife of Portland, Oregon, met their death on Mt. St. Helens on July 6th, while trying to descend the mountain in a snow storm. After continuous searching from the time they were lost until the 15th the mutilated body of Mr. Smith was found at the bottom of a 300 ft. crevasse. The neck was broken and one arm broken in two places. Mrs. Smith's body was found shortly afterwards. She doubtless perished from exposure and starvation. Mr. Smith was an assistant to the chief engineer of the Pacific Power & Light Company. He has been in Portland several years and both he and his wife were well known in engineering and social circles. They were active workers in the Rose City Park Club and were always willing to lend their support to any matter of public improvement. Mr. Smith was a son of Mrs. Emma Barnes Smith of Portland and the late Colonel Eliphos Smith. Mrs. Smith was the daughter of Professor John W. Newkirk of New York, and sister of Professor Burt L. Newkirk of Minneapolis, Minn. Mr. Smith was an associate members of the A. I. E. E. and the N. E. L. A. They are survived by a two-year-old daughter.

PIERSON, ROEDING & CO. MADE AGENTS FOR SAFETY INSULATED WIRE & CABLE CO.

The Safety Insulated Wire & Cable Company announces the appointment of Pierson, Roeding & Company of San Francisco, Los Angeles, Seattle and Portland, as exclusive selling representatives for the Pacific Coast, (effective August 1, 1913.) Mr. Ralph L. Phelps, manager of the Pacific Coast office for the past five years, has become associated with Pierson, Roeding & Company and will continue to personally represent the interests as manager of The Safety Insulated Wire and Cable department.

MEETING NOTICES.

Seattle Jovian League.

The Seattle Jovian League gave a special luncheon at the Rathskeller on July 18th. About 75 people were present, including invited guests. The meeting was held as a reunion among electrical men of the northwest. A special orchestra rendered appropriate music and a number of impromptu addresses were made by the invited guests. Among those from outside the city were H. W. Scott, electrical contractor, Astoria, Oregon; James F. Kinder, in charge station sales, Portland office, The Wise-Harrold Electric Company, New Philadelphia, Ohio; Mr. Squires of the Otis & Squires Company, San Francisco; Mr. Vandegrift, repre-

senting the Oakland Lamp Works of the National Lamp Companies; A. S. Moody, manager supply department, Portland office General Electric Company; Mr. Averill, manager Fobes Supply Company, Portland; Mr. Cleaver of the Granite Falls Electric Company, Granite Falls, Washington; Howard Gift of the Gift Electric Supply Company, Vancouver, B. C., and others. W. J. Grambs, president of the Northwest Light & Power Association, gave a talk on the forthcoming convention of the association at Seattle, September 3, 4, 5, and urged the Jovians to cooperate in every way not only to make the convention a success but to make the rejuvenation to be held during the convention a notable affair. Burton R. Stare, statesman of the Seattle Jovian League, talked on Jovianism in Seattle, discussing its benefits not only as a matter of sociability, but as an adjunct to business. He also urged that extraordinary efforts should be made by the individual members as well as the League to get a large number of new members into the order at the September meeting.

ANNUAL CONVENTION PACIFIC CLAIM AGENTS ASSOCIATION.

The fifth annual convention of the Pacific Claim Agents Association was held at Vancouver, B. C., on July 10th, 11th and 12th, 1913. At the opening session Mayor T. S. Baxter made an address of welcome on behalf of the city, urging co-operation on the part of all. Mr. F. R. Glover, representing the British Columbia Electric Railway Company, welcomed the delegates on behalf of the only electric railway outside of the United States which is connected with the association. Mr. Carson, president for the past year, spoke of the good work of the association, calling especial attention to the conviction of the notorious Maud Myrtle Johnson and the arrest of the fakers, W. A. Ward and J. N. Case. Mr. E. H. Odell of Tacoma, whose membership in the association had been terminated by virtue of his retirement from service with the Tacoma Railway & Power Company, was elected on honorary member by unanimous vote.

In the discussion on "Workmen's Compensation and Industrial Insurance Act," the convention was honored by the presence of three of the state of Washington commissioners, namely, F. L. Daggett, A. R. Ernst and J. F. Gillies, who joined heartily in the discussions, Mr. Daggett submitting a paper and making pertinent remarks thereon. Mr. Daggett particularly emphasized the fact that the state of Washington were pioneers in the establishing of laws for the compensation of workmen. Spokane, Wash., was set as the place of meeting for the convention in 1914. The following officers were elected for the year 1913-1914:

President J. H. Handlon, United Railroads of San Francisco; First Vice-President, T. H. Aston, Washington Water Power Company, Spokane, Wash.; Second Vice-President, A. M. Lee, Northern Pacific Railway Company, Seattle, Wash.; Third Vice-President, G. N. Smith, O.-W. R. R. & Nav. Company, Portland, Ore.; Secretary-Treasurer, E. H. Odell, Tacoma, Wash. Executive Committee: W. H. Moore, H. G. Winsor, A. E. Beck, H. K. Relf, T. A. Cole, S. A. Bishop.

Annual Meeting of the Pacific Claim Agents Index Bureau, Held in Vancouver, B. C.

On the evening of July 12, the annual meeting of the Index Bureau was held at the Hotel Elysium. Mr. Boynton, president for the past year, called the meeting to order and read a report of the year's work in detail calling attention to the numerous names and clippings filed. It was suggested by Mr. J. H. Handlon of San Francisco that very beneficial effect might result from advertising the work of the Index Bureau. It was voted therefore to have placards made bearing the words "Members of the Pacific Claim Agents Association" and "Subscribers to the Pacific Claim Agents Index Bureau," these placards to be placed in the offices of the members of other organizations. Various matters of importance were discussed after which the following officers for the coming year were elected:

President, Geo. Carson; First Vice-President, B. F. Boynton; Second Vice-President, W. H. Moore; Secretary, W. H. Odell; Treasurer, H. S. Winsor. Board of Directors: T. G. Ason, C. N. Smith, A. E. Beck, T. A. Cole, H. K. Relf, J. H. Handlon. Seattle was selected as the headquarters of the Bureau for the coming year.

TRADE NOTES.

George H. Keep Company, Tacoma, have the contract for rewiring the Raymond hotel for a system of lights and return call bells.

The Pacific Electric Manufacturing Company, San Francisco, shipped this week to the Cerro Depasco Mining Company, Callao, Peru, eight outdoor electrically controlled, 60,000 volt oil switches.

James O'Brien, electrical contractor, San Francisco, has completed the electric conduit installation for the Panama-Pacific International Exposition. Over 85,000 duct feet of Orangeburg fibre conduit were used.

The Pacific Electric Railroad Company of Los Angeles, has awarded the Union Switch & Signal Company the contract for installation of a block signal on the Venice line and the Pasadena short line as far as Indian Village.

Davis & Hull, electrical engineers and contractors, Tacoma, have remodeled their offices and have added a stock of supplies for heating, cooking, etc., on account of the heavy demand for these devices since the new city rates went into effect.

The Pacific States Electric Company has recently increased the capacity of their electric truck delivery system, making a total of five trucks in all now in use. Two have been placed in use in Los Angeles, two in San Francisco, and one in Oakland.

William A. Mullins Electric Company, Tacoma, has the contract for remodeling the wiring in the Horgan-Parks department store and has just completed wiring the Ruston city hall. In connection with the last job an electric fire siren was installed.

Lyman J. Maass, an employe of the city at the Interlake avenue substation, Seattle, was killed recently by an electric shock. Maass was a junior in the University of Washington, and was taking the course in electrical engineering. His father resides in Los Angeles.

The Seattle Construction & Dry Dock Company has a contract to construct a 250 foot ocean going yacht for J. E. Jackling of Salt Lake City. Same will be equipped with a 20 kw. generating set and complete storage battery. It will also have a complete telephone system as well as wireless apparatus.

S. H. Couch Company have recently established an agency in San Francisco for their autophone and intercommunicating telephone systems. The autophone system is particularly adaptable to hotel, office and factory use, the switchboard being automatic, the switch being made by the speaker at the time of using the receiver and is a simple and rapid system.

The A. G. Electric & Manufacturing Company, Seattle, has completed what is probably the largest front connected panel and cabinet job in the city for the Post Intelligencer to control the printing presses and the general power and lighting of the building. This company has also completed a monogram announcement panel for Pantages theater at Edmonton, Alberta, and another for Pantages theater at Portland

FINANCIAL NOTES.

The appointment in New York of Albert H. Wiggins, F. J. Close and R. H. Rhett as a protective committee for the holders of the $1,618,000 three-year 6 per cent notes of the United Light & Power Company of California, interest on which was defaulted June 1, was announced this week. More than $1,000,000 of these notes were sold from the New York office of the Smith-Tevis-Hanford Company, so that the majority of them are held in the east and not in California. R. G. Hanford of San Francisco, president of the United Light and Power Company, said that the past due interest on these notes would be paid prior to the 30 day limit allowed by the indenture, which would be September 1, 1913, and that these payments probably would be made around August 1. It is understood that a majority of these notes have already been deposited. One of the principal assets behind these notes is the contract for the supplying of power to the San Francisco- Oakland Terminal Railways, and other Smith traction properties.

Directors of the Oakland, Antioch & Eastern Railway report that they have received subscriptions from stockholders of the company for more than $200,000 of the company's authorized bond issue of $1,000,000. The sale of the entire issue to their stockholders would relieve the necessity for the proposed assessment on stock.

The statement of the Mt. Whitney Power & Electric Company, for the month of June, shows gross earnings for the current year of approximately $500,000 and for the month, $49,574.14, a gain of approximately 19 per cent for the year and 33 1-3 per cent for the month. The net earnings show corresponding gains of 19 and 28 per cent respectively. The comparative statement rendered by the company follows:

Year ending June 30.	1912.	1913
Gross earnings	$414,605.00	$491,773.58
Operating cost and taxes	189,758.00	233,864.22
Net earnings	224,847.00	257,909.36
Month of June.	1912.	1913.
Gross earnings	$37,160.00	$49,574.41
Operating cost and taxes	17,004.00	23,600.08
Net earnings	20,156.00	25,974.33

The Utah Power & Light Company and its operating subsidiaries report earnings for June, 1913, and the 12 months ended June 30, 1913, as follows:

	1913.	1912.	Changes.
June gross	$ 144,070	$ 116,857 Inc.	$27,212
Net after taxes	93,222	56,412 Inc.	36,810
12 months gross	1,543,212	1,478,223 Inc.	64,989
Net after taxes	875,091	814,124 Inc.	60,967

Earnings of all operating companies, now operated or controlled, are shown for the comparative periods, irrespective of the dates of their acquisition.

For May, 1913, gross earnings of the Portland Light & Power Company increased but $6039 or 1.15 per cent, while net earnings decreased $1236. Owing to larger interest charges, the surplus for the month was $117,969, a decrease of $12,546, or 9.6 per cent. For the 12 months ended May 31, 1913, gross increased $250,993, or 3.9 per cent, while net increased $152,443, or 4.7 per cent. Interest charges were $210,539, or 13 per cent larger than in the preceding year, so the surplus for the 12 months was $1,571,879, a decrease of $58,096, or 3.6 per cent, from 1912. The surplus was equivalent to 6.3 per cent on the $25,000,000 capital stock, on which dividends of 1¼ per cent quarterly are being paid.

The California State Railroad Commission has denied the application of the San Diego Consolidated Gas & Electric Company to issue 3148 shares of its common capital stock of the par value of $314,800. The corporation applied for authority to issue the stock to pay the discount upon its bonds issued since March, 1909. The commission decided that the discount on bonds should be made up out of the corporation's income, prorated over a series of years, and should not be capitalized by an issue of stock. The commission states that it is its policy to authorize stock for additions and betterments to a corporation's facilities or for the purpose of paying indebtedness incurred in the construction of additional facilities. It finds, however, in the present case, that the San Diego Consolidated Gas & Electric Company desires to use the proceeds from the sale of the stock for the purpose of paying the discount upon its bonds. The commission finds that, in addition to its regular 7 per cent dividend, the San Diego Consolidated Gas & Electric Company paid an extra dividend in 1912 in the sum of $255,600, and that this dividend went to its stockholder, the Standard Gas & Electric Company. The commission finds, further, that the San Diego Consolidated Gas & Electric Company now owes to the Standard Gas & Electric Company a large sum of money, which it proposes to liquidate from the sale of the stock. The commission expresses the opinion that if the San Diego Consolidated Gas & Electric Company had used the large surplus in paying its debt to the Standard Gas & Electric Company instead of declaring it an extra dividend, it would not now be put to the necessity of seeking to capitalize its bond discount. The commission has, therefore, denied the application.

A statement of earnings and expenses has been issued for June, 1913, and six months ended June 30, 1913, by the Great Western Power Company system. For the month it shows a net income from all sources of $175.813.95 and a surplus increase more than double that of June, 1912. For six months the net income, from all sources was $976,651.32 and the surplus was $408,299.94, as compared with a surplus of $251,815.62 for the same period of 1912. The statement follows:

Month of June, 1913—	
Gross operating income	$ 226,819.10
Operating expenses and taxes	66,307.60
Net operating income	$ 160,511.50
Other income	15,302.45
Net income from all sources	$ 175,813.95
Bond interest	95.108.33
Surplus for month of June, 1913	$ 80,705.62
1912—	
Surplus for month of June, 1912	$ 37,221.85
Increase 1913 over 1912	43,483.77
Six months ended June 30, 1913—	
Gross operating income	$1,317,905.35
Operating expenses and taxes	426,356.07
Net operating income	$ 891,549.28
Other income	85,102.04
Net income from all sources	$ 976,651.32
Bond interest	568,351.38
Surplus for six months ended June 30, 1913	$ 408,299.94
1912—	
Surplus for six months ended June 30, 1912	$ 251,815.62
Increase 1913 over 1912	156,484.32

Much interest has developed in the effect of the failure of the Kuhn Banks in Pennsylvania upon the interests of this concern in Idaho. The American Water Works & Guarantee Company, the holding company for the Kuhn irrigation and electrical projects, was forced into the hands of a receiver with the failure of the banks. Mr. S. H. Hayes of Boise, former attorney general, who has charge of the Kuhn interests in Idaho, is quoted as follows: "There will be no receiverships for the Idaho companies for the excellent reason that none are necessary. In my opinion there will be no change in the affairs of the Kuhns in Idaho in any material degree." It is understood that most of their electrical projects there on a substantial operating basis, and barring extraordinary conditions, should be able to continue operations without regard to the difficulties of the promoters and principal stockholders.

NEWS NOTES

ILLUMINATION.

NEWPORT BEACH, CAL.—The city has given the Pacific Light & Power Company a 40-year franchise.

CAMAS, WASH.—Bids will be received until August 12th, for furnishing lights for the town as per specifications on file in the office of the clerk.

SMITHFIELD, UTAH.—Messrs. Alma Chambers and John D. Plowman are investigating the proposition of installing and operating a municipal lighting plant in this town. They are visiting Brigham City and other cities in the state where such plants are in operation.

MARTINEZ, CAL.—An application for a gas franchise has been filed with the board of supervisors by S. Waldo Coleman of the Coast Counties Gas & Electric Company asking for a permit to traverse the county roads in laying pipe lines. Bids for the sale of the franchise will be received by the supervisors on August 18th.

HAILEY, IDAHO.—Harry J. Allen recently returned from Chicago where it is reported he completed arrangements for the construction of an electric light plant in Hailey. The Beaver Falls Light & Power Company have promised to extend their lines to the town of Hailey but so far have not done so, and this proposed plant is being considered on account of the failure of the Beaver Falls Company to supply service to the town.

PALO ALTO, CAL.—Because of a doubt as to whether the commission has power to regulate wholesale rates the application of the Palo Alto Gas Company to fix the wholesale rates for gas furnished under contract by the Pacific Gas & Electric Company, has been dismissed by Commissioner Thelen. It will be taken up again by the commission after August 10, when an amendment to the public utilities act giving the commission jurisdiction over wholesale rates will be effective.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has filed suits against the city of San Francisco and the city of Sacramento in the U. S. District Court to enjoin them from enforcing the gas rates for the coming fiscal year. The rate in San Francisco was 75c per 1000 feet for gas and 90c in Sacramento. A temporary restraining order was allowed in each case by Judge Van Fleet, made returnable July 28. The company declares it is being deprived of property by undue process of law and wants a rate fixed by the court that will net an income of 10 per cent on the invested value. It is asserted that the San Francisco rate would give an income of only $476,217.

TRANSMISSION.

SALEM, ORE.—State Engineer Lewis during the quarter ending June 30 issued 114 permits for the appropriation of water, 15 being for the construction of reservoirs and the development of 14,000 horsepower. Among the important permits were those issued to C. B. McConnell and Leonard and Emery Cole, of Burns, who plan the reclamation of 54,000 acres of land in Harney and Silver Creek valleys with the waters of Silvies River and Silver Creek. B. T. McBain, of Oregon City, for the development of 12,000 horsepower on the Clackamas River. The Dry Gulch Ditch Company, of Richland, Baker county, has appropriated the waters of Eagle Creek for the development of 1600 horsepower, and B. F. Jones, of Roseburg, contemplates the development of 1000 horsepower with the waters of Siletz River in Lincoln county.

SAN FRANCISCO, CAL.—Commissioner Thelen held a hearing on the application of the Pacific Gas & Electric Company for leave to build a new transmission line between power house No. 5 and Nicholas ravine—a component part of its Bear River project. E. Clements Horst who had obtained an injunction restraining the Pacific company from interfering with the natural flow of Bear River was represented by Samuel C. Wiel, who said that the Horst company owns 2000 miners' inches of the natural water flow of Bear Creek for irrigation purposes, and fears lest the plans of the Pacific company will deprive their hop ranches of this water right. J. P. Jollyman, the Pacific company's engineer, explained that his company intended to install six power houses along the course of its Bear River canal, one at each point where there was a natural fall of 550 to 300 ft.

BOISE, IDAHO.—Judge Bean has set July 31 as the date of trial for a suit brought by the State Bank of Chicago against the Idaho-Oregon Light & Power Company, F. N. B. Close and a bank which has interested itself in power development. Properties valued at $3,319,000 are involved in the suit. They are located in Baker county, Oregon; Ada Canyon, Boise and Washington counties, Idaho and Malheur county, Ore., with dam and reservoir sites and water rights on the Snake River. It is alleged that the Chicago bank is trustee for $7,000,000 worth of bonds issued by the power company, the first installment of which fell due April 1, 1913, and that the power company failed to redeem the bonds or pay the interest. It is alleged also that the power company pledged 5000 shares of stock in the Boise-Payette Power Company and 500 shares of Electric Power Company of Idaho and 250 shares in the Interstate Light & Water Company to the bank in addition to the mortgage. Interest to the amount of $94,345 is claimed.

SAN FRANCISCO, CAL.—Advices have been received by District Forester DuBois that the permit to the Pacific Light & Power Corporation for extension developments in the San Joaquin drainage has been signed by Secretary of Agriculture Houston. The permit provides for a progressive development including the Big Creek basin reservoir with a capacity of 103,000 acre feet to be impounded by three dams; the construction of power houses Nos. 1 to 4, operating under heads of 2091, 1951, 1440 and 478; the construction of a reservoir of 25,000 acre feet capacity on the San Joaquin River, and three steel tower transmission lines 292 miles long to Los Angeles. The structures in the development are of the highest type of engineering design and construction; the dams are to be of cyclopean concrete; the conducts, which are entirely in tunnel, are to be concrete lined except in solid granite. The power houses are to be of the most modern steel and concrete construction. One of the chief uses of power will be to supplant the supply now generated by steam by the Redondo plant of the company, since power can be furnished very much more cheaply from hydroelectric sources.

TRANSPORTATION.

PORTLAND, ORE.—A new application has been filed by Geo. F. Heusner for a franchise to use a loop defined by Flanders, Tenth, Salmon and Fourth on the west side. He has abandoned his plan for an interurban line on Broadway.

ASTORIA, ORE.—The Pacific Power & Light Company has announced that it will extend its street car line to the eastern limits of the city and to the Hammond Lumber Company's mill, provided the city will improve Date street for a distance of about 3000 ft.

DAVENPORT, WASH.—The Washington Water Power Company, Spokane, is planning the construction of a power transmission line for supplying power and lights to the towns of Creston, Wilbur, Almira, Hartline, Coulee City and Ephrata by way of this town.

SAN ANSELMO, CAL.—The San Anselmo trustees have granted a street railway franchise to S. J. Norton, acting for the San Rafael & San Anselmo Valley Railway Company, which proposes to connect this town with Fairfax and San Rafael, giving all three towns a street car system. The San Rafael council has not yet granted the franchise.

SALT LAKE CITY, UTAH.—Manager Robert Anderson of the Logan Rapid Transit Company announces that the work on the southern extension of the road which was stopped at Providence a few weeks ago will be resumed in about three weeks, and that the road will be built to Hyrum at least this fall. Sixty pound steel will be used on this extension.

SEATTLE, WASH.—Superintendent of Public Utilities A. L. Valentine in submitting his annual estimate for 1914 announces that it will cost the city $338,608 to operate and maintain the three proposed municipal street railway lines, one of which is now under construction. The earnings of the three lines are estimated at an equal amount.

SEATTLE, WASH.—Work has been started on the car barns of the Grays Harbor Railway & Light Company at Electric Park in Hoquiam. The barns are to be of latest style, to have concrete floors, steel frames and concrete roofs. The ground dimensions are to be 105x110 ft. Barns will be ready for occupancy within two months.

SACRAMENTO, CAL.—Two electric passenger locomotives will be operated on the Oakland, Antioch & Eastern line between Sacramento and Oakland. Each of the locomotives has a horsepower of 1000 and is capable of drawing a loaded train of six cars at the rate of 60 miles per hour. Another feature of the new line will be the observation car Moraga, which will have observation compartments at both ends, and will be capable of running under its own power or as a part of a train.

SUISUN, CAL.—Obstacles to the construction of the Northern Electric Railroad between Vacaville and Fairfield in the way of right of way difficulties have been settled by compromise and grading will proceed. The condemnation cases of the Northern Electric against the Consolidated Pacific Portland Cement Company and the Tolenas Cement Company and the Tolenas & Tidewater Railroad were set for last week before Judge Gregory of Butte county. Instead of hearings on the cases, notices of dismissals were filed in the court.

SAN FRANCISCO, CAL.—Bonds of any denomination may be sold by the city to aid in the extension of the municipal railway system to the Exposition grounds, according to an opinion handed down by the City Attorney's office. While it was at first believed that the charter provision making it necessary to stipulate the size of the bonds in the call for the election precluded this, decisions of the Supreme Court have been found that show minor changes can be made. It is proposed by the administration to divide the $3,500,000 bond issue that the people will vote upon next month into bonds of various denominations, so that people with small savings can invest in them.

STOCKTON, CAL.—Byron A. Bearce, president of the Tidewater Southern Railroad, announces that all the poles for the overhead electric circuits have been placed between Stockton and Modesto, and that wire stringing will be started soon. It is the expectation of the Tidewater official that the road will be electrified within a few months, and the old steam equipment disposed of. Work has been started on the Tidewater Southern bridge across the Mormon channel at Pilgrim street and as a large force of men is engaged in construction work it will not be very long before the railroad company will be using its own tracks into Stockton instead of coming over the Western Pacific as at present.

TELEPHONE AND TELEGRAPH.

EDMONTON, ALBERTA.—The government of Alberta is contemplating the construction of about 2400 miles of rural telephone lines. It is estimated that approximately $2,000,000 will be spent.

CLOVERDALE, CAL.—It is announced that one of the first undertakings of the California Telephone & Light Company when it secures control of the Cloverdale Light & Power Company's lines is to extend the lines along Dry Creek valley and down the western side of the river into the Healdsburg section.

SALEM, ORE.—In an order dismissing a complaint filed against the Pacific States Telephone & Telegraph Company, by C. P. Bowman, the railroad commission holds that under the law it has authority to direct physical connection between telephone companies. The decision is considered important, as this is the main question raised by the Pacific States Telephone Company in resisting the complaint before the commission by the Oregon Hotel Company, in which the latter asks that the telephone company be made to give an exchange service in the hotel with the Home Telephone Company. Bowman and others own a small telephone line in Eastern Oregon and desired to have the Pacific Telephone Company exchange service with it, but the commission dismissed the complaint on the ground that the particular connection requested was not public necessity.

WATERWORKS.

RED BLUFF, CAL.—Surveyors are making plans for a water system for Chino, having as a supply the north end of the Cone ranch and Antelope Creek and will pipe water a distance of 35 miles.

ABERDEEN, WASH.—A mortgage of $300,000 to J. O. Stearns as trustee was filed at Montesano in connection with bonds recently put out by the Hoquiam Water Company. The mortgage covers the water plant of that city and between 3000 and 4000 acres of land. A large part of the bonds will be used in extension of the system.

SANTA MONICA, CAL.—At a meeting of citizens and councilmen, it was decided to abandon the plan to create a municipal water plant by units, beginning at the southern end of the city, and instead to purchase two modern fire engines, one for Ocean Park and one for Santa Monica proper. The proposition of a municipal water system will probably be put up to the people in a bond issue.

SEATTLE, WASH.—The city utilities committee of the city council will introduce a bill transferring $80,000 from the 1911 Cedar River water supply extension fund to the 1915 fund of the same title in order that the city may proceed with the construction of a portion of the tunnel beneath the government canal near Seventh avenue northeast, which will carry city water mains and other public service utilities.

SAN FRANCISCO, CAL.—The board of works has arranged with Major General A. Murray to install an additional pipe line in the Fort Mason reservation to connect the Fort Mason pumping station of the auxiliary fire-protection system with the high pressure mains. The city is to put in three fire hydrants at Fort Mason, connecting with this pipe, and is to join the water system of the reservation to the high pressure valves.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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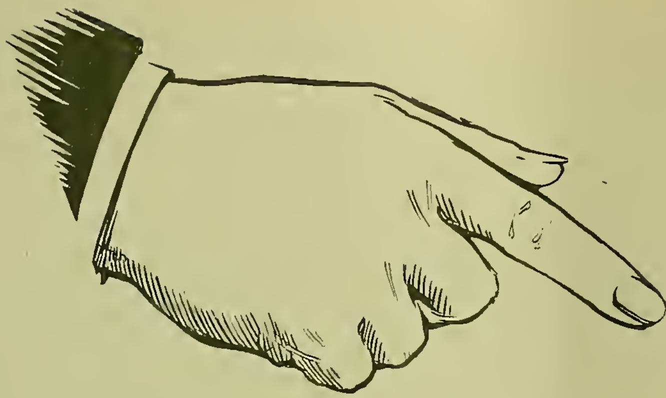
Where to Buy It in the West, Pages 9, 10.

Alphabetical Index to Advertisers, Page 8.



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POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI — SAN FRANCISCO, AUGUST 2, 1913 — NUMBER 5

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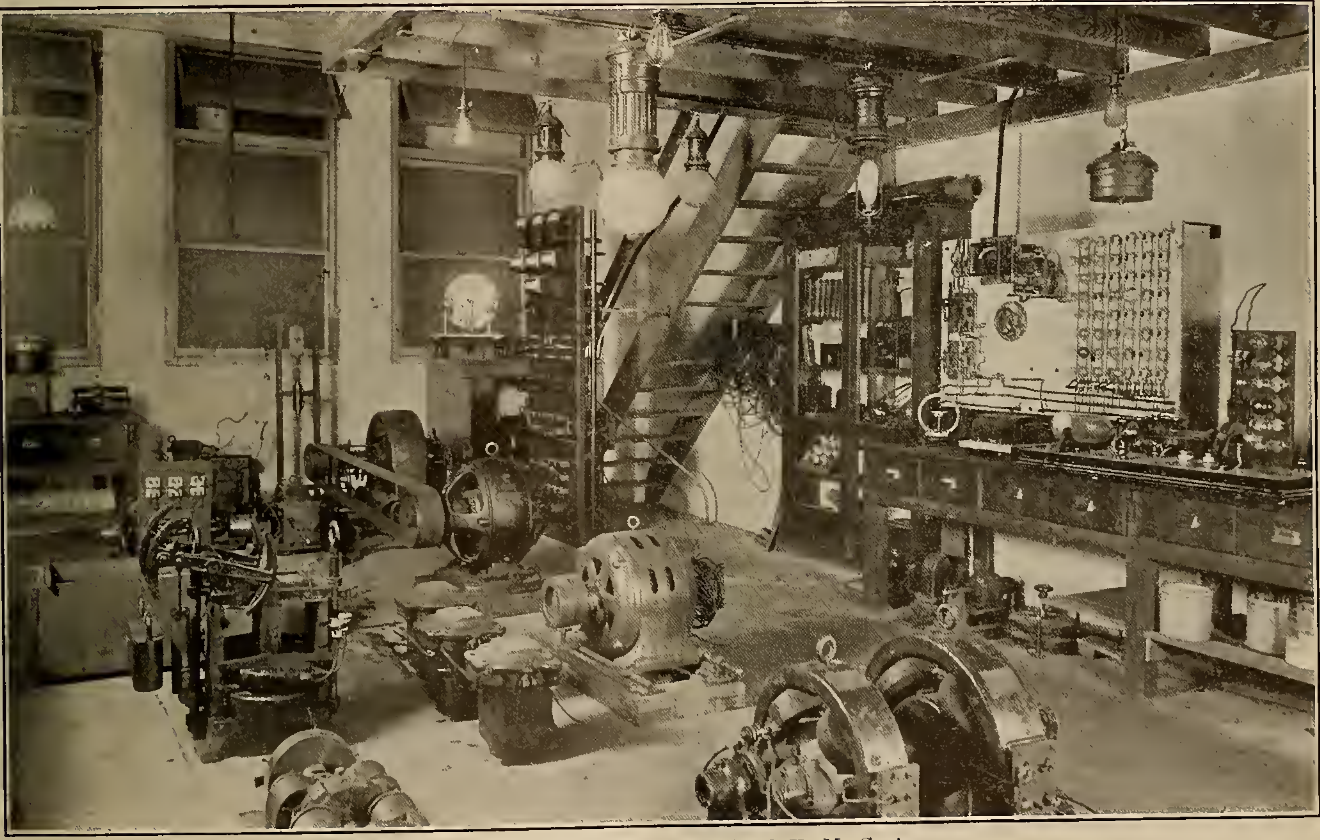
THE Y. M. C. A. AS A LOCAL TECHNICAL SCHOOL

BY W. HAYNES.



Electrical Laboratory at Portland Y. M. C. A.

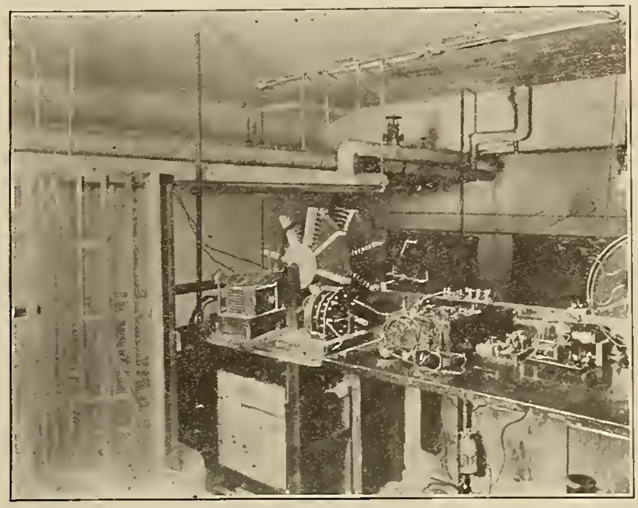
The tendency of up-to-date educational institutions, both public and private, is toward combination of similar schools and courses. Communities more than ever before are questioning the legitimacy of any enterprise which seeks public support, and on the other hand, if a real need is found, these same communities respond more willingly than ever before.

The response, however, is generally conditioned upon the deep seated principles of business efficiency, which have been shown to hold wherever large sums of money are expended. Between these popular beliefs and the conservative views held by the association's board of management, success can be hoped for only the most worthy undertakings. It must be remembered that this board is generally composed of men who have succeeded in their own particular business enterprises, that they are responsible for raising the association's funds and that they are the court of last appeal on questions of additional expense.

Three years ago the educational department of the Portland, Oregon, Young Men's Christian Association felt that a real need existed for a high grade course in certain electrical engineering subjects. For many years the association had given a course in "electricity." This course was about equivalent to the section of "electricity and magnetism" given in an ordinary course of high school physics. In order to give a course which would be an actual benefit to the students, a laboratory was seen to be indispensable. Upon investigation it was found that a desirable equipment for properly demonstrating engineering phenomena would cost between four and five thousand

dollars. Clearly this expenditure could not be made without the sanction of the above mentioned board. The essence of the arguments made to secure this appropriation will perhaps give a clearer conception of the problem from the association's standpoint than is held by the average layman.

Many men begin work with an electric company without a technical education and in the discharge of their duties "make good" and are advanced to a slightly better position. These men are frequently made "straw bosses" and find that they are called upon to decide certain technical questions. If they decide rightly, they strengthen their position with the company, and their men. If they fail in any serious case, they are either discharged, reduced in rank or at least



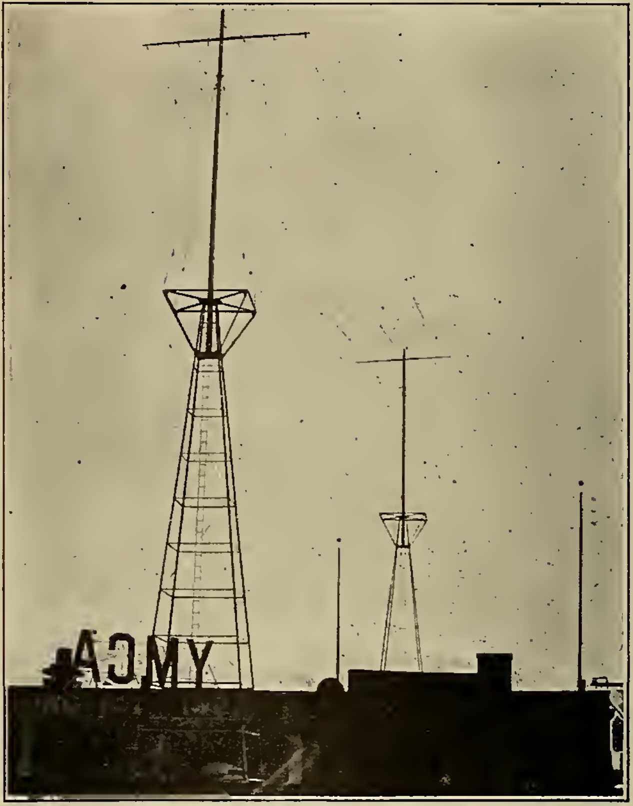
5 kw. Wireless Telegraph Set.

embarrassed before their subordinates and superior officers. Another class is represented by bookkeepers, inspectors, agents, linemen, etc., of electrical companies. They do not need a full university course in electrical engineering, but each requires special training along some particular line, generally a non-mathematical treatment of a single branch of electrical engineering considered in its broader sense. The constituents of these classes cannot enter a university for one or more of the following reasons:

Some haven't enough elementary education. A good many are without even a full grammar school education. Some cannot afford the expense attendant upon college education. Some are married and have families which demand the salary or wages of the husbands. Some are supporting widowed mothers and sisters, often supporting younger children while attending public schools. Some have graduated from colleges of engineering before, but being out of the profession for several years find that a review of certain subjects will aid them in their work. Others have graduated from colleges whose teachers were not practical electrical engineers, and after meeting real problems in actual practice find themselves too weak and untrained to work in confidence. Some have tried to learn electrical engineering by correspondence, and discovered the need of well directed laboratory work.

All these classes of men and many more have presented their case to the Young Men's Christian Association, as the one institution which is free to act according to its conception of men's needs. If the association could install the necessary equipment, secure the proper faculty and give the course at such times and prices as the prospective students could meet; it would serve a large and most worthy class in its locality.

Suffice it to say that the board approved the plans of the educational department and the electrical department was organized. The best room in the building was selected and fitted up as the electrical laboratory. The equipment now on hand is worth something over four thousand dollars, with approximately seven hundred dollars worth of equipment yet to be secured. Most of the apparatus on hand is new and up-to-date. In fact, most of the equipment was made especially



Aerials for Wireless Telegraphy.

for this laboratory and similar to that which may be seen in any of the regular engineering laboratories connected with our colleges.

Another instance of the association's meeting a popular demand was just after the Titanic disaster, when many persons applied for a good course in wireless telegraphy. Again the board provided the funds for purchasing a fourteen hundred dollar equipment. One of the illustrations shows the 5 kw. sending and receiving set. This set is a regular commercial set, and so far as we know, is the best wireless set owned by any Young Men's Christian Association in the world. Another shows the aerial used for the wireless station. It consists of two steel towers, 400 ft. apart and hold the aerial 180 ft. above the streets.

The growth of the electrical school is indicated by the increase in enrollment from 53 in 1911 to 68 in 1912 and 88 in 1913.

HYDRAULICS I.
(The Bernouilli Theorem.)

BY OTTO B. GOLDMAN.

In all of the following we assume that the fluid is incompressible and free from friction or viscosity. Starting first with the Bernouilli theorem, which is simply a statement of the conservation of energy, we have as usually given

$$Z + \frac{P}{W} + \frac{V^2}{2g} = H, \text{ a constant} \quad \ldots\ldots\ldots\ldots (1)$$

Where Z is the elevation afore datum, P the absolute pressure, V, the velocity, and H, what might be called the absolute head.

$$P = p_0 + p \quad \ldots\ldots\ldots\ldots (2)$$

$$\text{and } H = \frac{p_0}{W} + h \quad \ldots\ldots\ldots\ldots (3)$$

Where p is the gauge pressure.
p_0 is the atmospheric pressure.
h is the actual head.

Substituting in (1) we get a simpler and more practical form of this equation, viz:

$$Z + \frac{p_0}{W} + \frac{p}{V} + \frac{V^2}{2g} = \frac{p_0}{W} + h$$

$$Z + \frac{p}{W} + \frac{V^2}{2g} = h \quad \ldots\ldots\ldots\ldots (4)$$

Assuming in the following, for simplicity, that the axis of the passage is on the datum line, we get

$$Z = O$$

$$\frac{p}{W} + \frac{V^2}{2g} = h \quad \ldots\ldots\ldots\ldots (5)$$

$$\text{or } V = \sqrt{2g\left(h - \frac{p}{W}\right)} \quad \ldots\ldots\ldots\ldots (6$$

in which g, h and W are constants.

When p = O

$$V = \sqrt{2gh} \quad \ldots\ldots\ldots\ldots (7)$$

which is the velocity of a body falling under the influence of gravity, freely in a vacuum and is therefore the maximum value that V can obtain. At this point all the energy has been converted into velocity energy.

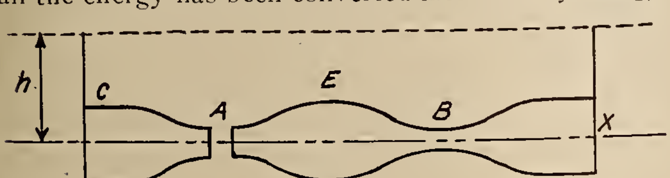


Fig. 1

In the sketch Fig. 1, the area at A is such that $V = \sqrt{2gh}$, and therefore p = O.

Many treatises on hydraulics assume that we can make a fluid fall faster than $V = \sqrt{2gh}$ by assuming at a point B, Fig. 1, that the area is less than that at A, as or example in Bovey's Hydraulics, page 15. However the assumption, that he makes is that inasmuch as a certain quantity of fluid passes at A, the same quantity must pass at B, which is of course an error. The assumption seems to be made to avoid spilling water at A. If we assume the distance C, B to be zero, under Borey's assumption, we would get a contradiction of Torricelli's Theorem. So therefore a negative pressure at B cannot be obtained except we assume frictional resistance and the consequent conversion of part of the velocity energy.

Electric maturing of cheese is employed by a Rotterdam firm, who subject a fresh cheese to an alternating current for 24 hours to give it all the properties of a fine two-year-old cheese.

Ammonia bombs are being tried out on some of the national forests for the purpose of extinguishing forest fires. They are said to have worked well in the case of brush fires where the fire-fighters find difficulty in getting near enough to the burning area to beat out the flames. Each bomb exploded will extinguish fire in a circle of about five yards in diameter.

The Western Pacific Railway has instructed its engineers to report fires along the right-of-way where it traverses the Plumas national forest, California. The location of fires is indicated on a card dropped by the engineer or fireman to the next section crew met after the fire is discovered. It is then the duty of part of the section crew to go back on handcars or speeders and put out the blaze.

The heating of screw socket lampholders as investigated by the National Physical Laboratory of England, is almost entirely due to the heat dissipated by the lamp or radiator, and has little to do with the energy lost at the contacts, the latter being neglible unless the holder becomes defective. Such sockets can satisfactorily transmit as much as 1000 watts, whereas bayonet holders are not satisfactory for over 250 watts. Whereas tested temperatures as high as 120 degrees do not damage the sockets, the effect of the heat on insulation of incoming cables is likely to be serious.

Forest Service permits for power development in California have been issued by the secretary of agriculture to the Pacific Light & Power Corporation of Los Angeles, California, to construct and operate a series of power plants in the Sierra national forest. The company plans to build four power houses, two reservoirs, and twenty-five miles of cement-lined tunnels. On account of the magnitude of the construction work and the amount of power to be disposed of, the permit provides for construction extending over a period of twelve years. Under a temporary permit the company has already nearly completed the first step of this development, known as the "Big Creek Project." The power will be transmitted over a double steel tower line strung with stranded aluminum cables and at a pressure of 150,000 volts.

ELECTRICITY AND THE ARCHITECT.

BY FRANK E. WALLIS.

[The relations which should exist between the architect and the engineer have seldom been so well presented as in Mr. Wallis' address at the recent conference of the Society for Electrical Development. With slight modifications they are published herewith.—The Editor.]

Light is the fundamental source of design and composition in architecture, high lights, shades and shadows being the pigments with which the architect expresses himself. Remembering that the Greek temples and the Gothic cathedrals were designed by architects who depended on the light of the sun for the lead in their pencils, electrical men must appreciate the importance of their inventive powers, as they have practically formed a light trust in competition with the Almighty, and natural light is useful today only for a minor portion of our waking hours.

The modern architect must, when designing and composing his interiors and his exteriors of homes, churches, public buildings and offices, take under careful advisement the use and misuse of light, and in designing his cornices, his moldings and his solids he must, in lieu of a pencil tipped with sunlight, supply himself with an electric light point.

The electrical engineer, however, in his efforts to parallel the light of the sun, has forgotten the shadow in his struggle for artificial daylight. This may be extremely useful and sane in many places, but forbear, I beg of you, the violation of the law which gives us the subtle shades and shadows, fleeting mysterious, and housing dreams and fairies, the inspiration of song and story for the poet and the artist since the world was young.

Remember the story of the efficiency engineer with his stop watch held on a couple of young people kissing. "You have used sixteen motions for that kiss, when it should have been done in two," forgetting that the fourteen love pats were worth more than the kiss, and so that shadows and shades are of more value than the perfect light.

In addition I want to suggest the necessity of some knowledge of the styles and of some of the laws of architecture so that you may comprehend to some extent the desire of the architect to soften or to accentuate his work with light and her sister shade, and that you may at the same time join with him in the development of good architecture and of good business.

In the great modern renaissance in the arts and sciences where the city authorities of this country are planning their great civic centers of magnificent court houses and monumental city halls, light, properly designed and properly placed, is a most important factor, but a factor that is more or less neglected. The architects of the Panama Exposition are designing great courts surrounded by facades with monuments, fountains and sunken gardens which will be seen and appreciated by the public during the greater portion of the time with the aid of your substitute for God's sunlight. Electrical men should insist on the recognition of their high place in the councils of trained imagination and should demand some share of the glory which comes from the result of their deliberations.

I would suggest that the Society for Electrical Development appoint a committee to consult in some official capacity with the American Institute of Architects. This society, with the central body in Washington, made up of permanent and working committees on competition, on education, and on laws, has chapters throughout the United States, each chapter working in the same manner in its own locality. Consulted by presidents, by governors, and by the mayors of cities, the society has done work of a great educational value. I, myself, am a Fellow of the Institute and know from the inside the broad-gauged co-operative work which is being done, and I am sure that through the official monthly publication of the Institute or through some method which only such an organization as yours could devise, co-operation could be had where the question of education could be developed. Care should be taken, however, to approach this question only through the higher channels of your mind, for the Institute develops gooseflesh at the mere mention of commercialism, being ultra-professional, and wisely so.

All of us will do better work when we do it in a broad-minded spirit of co-operation and the returns, both financial and otherwise, will be greater according to the greatness of our ideals.

Let me also beg of you as a practicing architect with the peculiar difficulties which always surround our profession, to send your gospel of more light, and better light, of heat and power, and the economies of electricity, the enemy of disease, of crime and of barbarism, to our public officials and to our clients, so that you may enjoy with us the game of life and light and color.

For according to the quality of your offering to the real civilization, so shall its returns be to you.

"In the ranks of industrialism the baton of the field marshal is at the bottom of every recruit's knapsack, although not everyone has the wit to find it."

I had an interesting and instructive visit with Mr. Leon Gaster while in London this winter. He is doing great work both with the Continental governments and with the British parliament on efficiency lighting in factories and workshops. He remarks that the boards of health seem to care more for the posterior end of the alimentary canal than for the windows of the soul, and he has insisted that the various boards of health should consider carefully the effect of light on the health of the workman.

I am now going to presume on my position as a guest and criticize you. My premises are these: While the composer in form, called by the conventional the artist, works with his trained and fluid imagination, he does so subject to fixed and scientific laws which are the result of time and study, and which have been subject to the most jealous scrutiny. It is because of his knowledge of these fixed laws that he admires and marvels at the work of the engineer. The engineer, illuminating or otherwise, makes little, if any, allowance for the excited enthusiasm of the man who composes, knowing the laws but playing with them, for he frequently confuses this exhilaration and keen expression of love with the uncertain and the

false, though sometimes helpful, inspiration which comes from the long bottle. And in addition, the artist, in his mind, is most frequently queer.

Now the man who creates feels this and resents it, and very naturally shys from an association with this sort of scorn.

You men of the central stations, of the manufactories, of contractors and of the sales departments must know that a close relation between yourselves and the architects can only result in economy of construction, in the development of each portion of the work, in added profits to all of us, and to an increase in the returns to the owner on his investment.

We have in our office at the present time a couple of factories, an office building, a loft building, some country houses, some landscape work, a laboratory, and odds and ends of consideration and alteration. All of these problems are worked out under the same formula and with the assistance of engineers of the various requirements, and of clever salesmen and supply men. We architects want co-operation, and this criticism suggests that while you should learn something of us, that we should also learn from you and welcome your data and your suggestions.

Finally, I would like to grow a little personal with you. I am one of those whom men call, to my sorrow, an artistic man, but only because I have the love of form and color. I have wandered among the old and the new, having no prejudices and no preconceived notions, although I have made in my peregrinations a collection of clients and added to my library on human nature.

I have gathered both cash and credit, and as well, the friendship of some of the members of your organization. There I have found men of all types; men with broad views and men with hungry pockets, men who will live and men who lose, men as clever as the fox of Richelieu and men as loggy as the sow of despondency.

I have visions of your dreams and knowledge of your difficulties, and I have this message for the real men who have a desire for success through their business association. In my opinion you are playing the big thing. You have the power of happiness in your hands, both for you and your families and the world. Play the big game and play it to the limit of your powers. You have all the essentials of life in your palms, heat, power and light. Without them we relapse into barbarism and to you, rather than to the ministers of the gospel, we look for salvation and progress. Study the broad way and avoid the petty. Realize that yours is the method and the manner which will guarantee big returns, in warmth from your control of heat, in progress because you have power, and in light and love, for from you we must get all the joy of life. You owe to the civilization of the future more, much more, than the civilization of the past has given to you, and you are given a privilege which is not given to men of other business.

You are parallel with nature and with the Almighty. Play the game or lose yourself in the loneliness of failure and of self-prostitution; for when you play the game and play it big you must be insured the big profits, and this need not necessarily mean an enlarged bank account.

ELECTRIC IRRIGATION OR THE MOTOR'S CONQUEST OF THE DESERT.

BY W. L. FROST.[1]

Come and we will stand on Smiley Heights and I will point to you the miracle of electric irrigation and tell you a story of the chemistry of water and soil.

Below us are the streets of Redlands, and stretching to the north and the south and the east and the west are the citrus groves—the glory and pride of the southwest. They wear a perennial verdure. Dotted among them are spots of lighter green. These are the walnuts, the peaches, apricots, the plums, the apples, the alfalfa, the berries, the vegetable gardens and the vineyards of the California grape.

Look again—look sharper. Focus these field glasses on the groves and fields and gardens. The landscape seems set in a cobweb of silver. It is the July sun shimmering on the irrigation canals and the lateral trenches that carry the life-giving waters to the roots of growing things. The prospect pleases you? It has pleased many. Yes, these wonderful productive lands are valuable from a commercial standpoint. They combine good business and unique beauty. They range from two thousand dollars and up per acre.

Search the old Spanish records and you will find that once they sold for as low as twenty cents an acre and we are told that they were unprofitable at that ridiculous price. What has wrought this wonderful change? The art of irrigation. Practically all that you see before you is under electric irrigation by power supplied by the Southern California Edison Company. You can follow the power lines of this company through the seven counties of Southern California and you will see the picture that I am pointing out to you duplicated in full fifty valleys. No, the art of irrigation or science if you prefer the term, did not spring into its present perfection at one bound. Like most great achievements it took time and study and courage and patience to develop—some sixty odd years as its history runs in Southern California.

It is true that Father Junipero Serro and his Franciscan Brothers watered by artificial methods the gardens about their missions, but their methods were nearly as primitive as those of Pharaoh's slaves who grew their crops where the Nile had overflowed its banks. According to the legend as it has been told to me—one Captain Jefferson Hunt, on disbanding his company of Mormon volunteers at the close of our war with Mexico, passed through San Bernardino Valley on his way back to Utah, and noting the rank growth of vegetation along the water courses, told of what he had seen to Brigham Young. This prophet, anxious at that period to expand the boundaries of his church, and having by irrigation successfully re-claimed the arid lands about the Great Salt Lake, sent out a company of some five hundred of the faithful to colonize the valley of which Hunt had so glowingly reported. The first detachment of this band crossed the Cajon pass and encamped near San Bernardino on June 10, 1851. By damming the mountain streams that came roaring down into the

[1]District Agent Southern California Edison Company, Redlands, Cal.

valleys and diverting the water through lateral trenches, these Mormon colonists put the low levels under irrigation and intensive and profitable cultivation. Chaparall, sagebrush and grease wood vanished before their intelligent tillage and great prosperity, seemed at hand in the year 1858, when gentile hostilities threatened the Mormon hierarchy and the prophet issued an edict calling his wandering children back to Zion to defend the Church, and most of them obeyed. So ended what is known as the Mormon era, which introduced our systematic irrigation.

Following the Mormons came the Gringos, as all except those of the Spanish race were then termed. They bought the cultivated acres of the departing Saints at bargain prices, and they extended the trenches and dammed the rivers at higher levels, and spread the waters on practically all of the land over which it would flow through open trenches. Impounding the flow of the rivers in reservoirs and forcing the water by gravity, in standpipes, to higher levels, was the next expedient for enlarging the sphere of irrigation, but this had its limitation. Excepting under unusual topographical conditions gravity irrigation is the most wasteful of waters. Underlying nearly all of Southern California are subterranean water basins which can be tapped at varying depths by wells. This subterranean water swollen by the seepage from irrigated acres flows down to the ocean and is lost forever to the purposes of man.

Raising the waters from canals and wells was the next step in the extension of the early irrigation system. The ancient windmill with its gaily painted blades—picturesque; but clattering and intermittent, was the first power to drive the pumps that lifted the water, but winds were lazy and uncertain and often the orchardist was obliged to watch the leaves and buds of his young trees wither, while like a becalmed mariner he prayed for rain, but in spite of all of its crude disadvantages the windmill expanded the era of irrigation. It was about the time that the old windmills were clattering themselves to pieces that the importation of the seedless, or what is known as the Washington Navel Orange from Bahia, Brazil, gave an enormous impetus to California fruit in the eastern market. Train loads of winter tourists were beginning to wind their way across the desert from Yuma and Needles.

They studied irrigation and intensive cultivation, and they found that ours was not a land of the lotus, but an empire awaiting the magic alchemistry of soil and water. The limit of gravity irrigation had about been reached, and the whimsical windmill did not appeal to men who were accustomed to see the wheels go around at their bidding, but the gasoline engine came as the answer at the opportune time, when men of means and enterprise were looking for land and seeking opportunity to engage in citrus culture. The gas engine was fairly reliable if an expert engineer stood over it to coax it and to chide it when it balked, but the big ranchmen were glad to pay the great cost of its installation and maintenance. Its life was scarcely seven years, which with the cost of fuel and the salary of the engineer made the expense of operation a heavy burden and a drain on the profits of the industry. Engines of from five horsepower up were installed and streams bearing ten to three hundred and fifty miners' inches were obtained. In spite of their extravagant expense and their smell and their noise these engines did good work in their day and generation, but this is the electric age and before the silent unseen force they vanished to remote places of the earth to keep company with the kerosene lamp.

It was the Southern California Edison Company that ushered in the electric era, by constructing hydroelectric generating plants in the mountains, and carrying the current over high voltage transmission lines to the fields and groves and arid land of Southern California. It gave to the ranchman, orchardist and the gardener a pumping power that is ever ready and efficient, reliable, cheap of installation, requires no personal supervision and costs nothing when it is not actually working. As a result scores of irrigation companies sprang into existence and large Spanish Rancheros were subdivided into small holdings upon which oranges, lemons, deciduous fruits, vegetables and alfalfa are profitably grown.

Practically all of the gasoline engines within the reach of the Southern California Edison Company's lines have been replaced by the silent electric motor and this in less than twelve years.

This is a pumping plant. We enter the building and we are alone. There is no engineer on duty because there is need of none. All is silent save for the swish of the water as the great pump sends it out to mingle with the earth. The great wheels turn as silently as the planets and there is something about the invisible power that is doing its work with strength and quietude that reminds us of the forces that move the universe.

We have talked of the past, and we have seen the present. Before the sun dips into the Pacific, we have yet time to look over into the future. Our way leads up through the San Gorgonio pass to where stretching out before us lies the great drab desert with its hush of death.

Do you see that field off to our left—green with the bright greenness of the shamrock? That is alfalfa under electric irrigation. Did it ever occur to you that alfalfa is milk, butter, cheese and mutton and beef? Plant every arid acre of Southern California to alfalfa, irrigated with electricity, and crop it at each new moon, and send to market in the form of cattle and hogs and sheep and yet the mouths of our hundred million population will call for more pork and mutton and beef.

Look back and see what the setting sun is showing us! A land of homes that nestle among the verdure that irrigation has created.

Now we can view the future—see that line of green where cultivation has crept down to do battle with the sage and the cacti!

Mark it well, and fix your bearings by some mountain peak so that you will remember it. For a few years hence we will come again. Then you will see how the electric motor has advanced its conquest against the sage and the cacti, and what is now a desert "Will blossom as the rose."

ELECTRICAL PUMPING AND IRRIGATION

DISTRIBUTION SYSTEMS.

BY B. A. ETCHEVERRY.

The great majority of irrigation distribution systems consist of open canals or ditches in earth, but there are special conditions and difficulties which have led to a number of smaller irrigation systems, usually under 10,000 acres in extent, built largely or entirely either of wooden flumes, or wooden pipes as in some sections of eastern Washington, southern Idaho, northeast Oregon and British Columbia; or else cement pipe as used for many years in southern California and more recently in the above named states. Some of these conditions are the following:

1. The topography of the country, although not especially rough, is irregular, having no general gradual slope and no well formed ridges. This requires that laterals pass successively from a ridge to a depression making it necessary to use either fluming or pipes for at least a considerable portion of the lateral.

2. The topography is rough and steep which gives steep and irregular grades to the laterals. The high velocity which these grades would give in an open canal would require frequent drops or canal linings. The irregular grades and depressions would have to be crossed by means of pipes or flumes. These conditions may be favorable to pipe or flume systems, for the high grades would permit the use of small size pipes or flumes, which may be more economical than canals. Pipes are usually preferable to flumes for deep depressions requiring high trestles.

3. The volumes of water to be conveyed are small, the water is valuable and the seepage losses must be prevented. The choice is between cement lined canal, flumes, or pipes. These conditions are obtained when the water is valuable because of its scarcity or the high cost of pumping or storage.

Other advantages of pipes over canal or flumes are: (1) they do away with the structures necessary for road crossings over canals; (2) they do not occupy any land which is wasted; (3) they do not collect the dirt and rubbish that fall in open canals.

On the other hand pipes, and to some extent flumes, are only feasible for comparatively small volumes of water and their cost may be prohibitive.

A wooden flume system will consist of main flumes, and lateral flumes, supported on mudsills or on trestles and ranging from the larger sizes down to 10 x 12 in. flumes or smaller. Flume systems become expensive both in first cost and in ultimate cost when the average height of trestles becomes large, and it may be more economical to use pipes.

Pipe systems used for this purpose are wood-banded pipe, vitrified sewer pipe, cement mortar or cement concrete pipe. Wood pipes have the great disadvantage that they are not durable unless kept saturated continuously, but have the advantage that they can be quickly put together. Metal pipes are too expensive and not very durable. Sewer pipe is usually more expensive than cement pipe. Cement pipe is preferable to other materials for low pressures and have been used almost exclusively for the many pipe systems of southern California. Wooden pipes are more commonly used than any other kind for high pressures, but not to exceed 400 ft. The design of wooden pipes has already been discussed. Because of the increasing use of non-reinforced cement pipes for distribution systems where water is valuable and is to be distributed in small volume a rather complete description of this kind of pipe, its properties and method of manufacture is given.

Cement pipe. The cement pipe so extensively used in southern California is made in sections 2 ft. long. One end of the pipe tapers in and the other end tapers out so that when two pipes are joined together they form a bevelled lap joint. This form of joint is preferred to bell joint used for sewer pipes because the outside of the pipe is straight and the pipe is easier to lay; it also requires less material to manufacture. The pipe is made by means of metal moulds in which a moist mixture of cement and sand or cement and gravel is carefully tamped. The mixture is comparatively dry in order that the moulds may be removed to be used again immediately after the tamping is finished. This is necessary to obtain a large output with one set of moulds and as much as 100 ft. a day of 30 in. pipe and 500 to 400 ft. of 6 to 8 in. pipe are made by experienced pipe men with one set. After the pipe is made it is carefully cured by being kept moist for at least one week and allowed to harden. At the end of a month it is ready to be laid and joined in the trench with cement mortar. The sizes commonly used are 6, 8 and 10 in. inside diameter for private distributing lines and 10 to 30 or even 36 and 48 in. for the main lines of the irrigation system. The sizes to use in any case depend on the desired carrying capacity and the grade or fall obtainable.

The cement pipe, as manufactured by this dry process, has not the same strength nor is it as impermeable as a pipe made with a wet concrete and can only be used to cross shallow depressions or where the pressure is moderate. The pressure which it will safely stand depends on the efficiency of the manufacture, the mixture used and the diameter of the pipe. The writer recommends the following values as safe for pipes manufactured with care:

Diameter of pipe in inches.	Maximum pressure head in feet. 1 to 2 mixture.	1 to 3 mixture.	1 to 4 mixture.
12	20	15	12
14	20	15	12
[illegible]	18	14	10
[illegible]	18	14	10
20	16	12	8
24	16	10	6
30	12	8	6

With unusual care, experienced pipe men can make pipe which will stand safely 30 per cent greater heads than those given in the above table.

The use of hand tamped non-reinforced pipe is therefore limited to low pressures and great care must be used in planning and constructing pipe lines in

order that the safe pressures recommended above be not exceeded and all sudden stresses or pulsations which are likely to occur where air is allowed to accumulate in the pipe line must be prevented by providing ample air vents or air inlets at all summits in the pipe line. These air inlets can be formed by cutting a hole in the pipe and cementing to it a vertical stand pipe made of several sections of cement pipes, the lower end of which is cut to saddle around the hole and the upper end extending above the height to which water will rise.

Manufacturing Hand Tamped Cement Pipes.

The mixtures used depend on the material available. With good clean pit gravel containing about 50 to 60 per cent sand, less cement can be used than with sand alone. The mixtures commonly used are 1 part

Moulds for Making Hand Tamped Cement Pipe.

of cement to 4 parts of pit gravel and sand for pipes up to 18 in. in diameter, and 1 part of cement to 3 parts of gravel and sand for larger pipes. If crushed rock or screened gravel is used a good mixture is 1 part of cement to 2 of sand and 3 or 4 of gravel or rock. No gravel or rock larger than one-half the thickness of the pipe should be used. To make the pipe more nearly water tight 5 per cent of the weight of cement in hydrated lime is added. The sand and gravel must be free from dirt or organic matter.

Mixing is usually done by hand and in small batches, but for a large plant concrete mixers are advisable. The materials are mixed by means of a hoe or shovel; they should be mixed three times dry and three times wet. While it is desirable to use as much water as possible, only sufficient water is added to the mixture to give the consistency of damp earth which will retain its shape when squeezed in the hand. When too much water is added the mix will stick to the mould and the pipe will collapse when the mould is removed. In order to make the ends smoother, some manufacturers use for the ends a finer and richer mixture made of 1 part of cement to 2½ or 3 of screened sand.

The moulds consist of a set of base rings which are bevelled to form the base of the pipe, an inside core, an outside jacket, a funnelled sheet iron hopper, a rimmer or cast iron ring which fits around the inside core and bevelled on the inside edge, a tamping bar and a feeding scoop. The pipe is usually made on a solid platform or levelled area. To set the mould in position the inside core is placed inside of the base ring and clamped tight to it by turning a lever, the outside jacket is placed around the base ring and contracted by turning a lever. The hopper fits on the top of the outside jacket. The mortar is fed in the moulds and spread in thin layers one to two inches thick. Each layer must be carefully and uniformly tamped all around the inside core in order that the core be not shifted and the pipe made of unequal thickness. When the last layer has been tamped a little extra material is placed all around the top and the hopper is removed; the rimmer is then placed around the inside core, is jammed down and revolved, at the same time pressing down on the pipe. The inside core is now contracted and removed; the rimmer is taken off. If the pipe has been made on a platform it is now car-

Process of Tamping Mortar in Moulds.

ried by means of lifting hooks with the jacket still clamped on the base ring and placed on level ground. The jacket is now released and removed and the pipe left on the base ring until it has hardened. For large size pipe to avoid lifting and carrying the pipe, the base rings are placed on the levelled ground instead of on the platform.

Where the pipes have to be used for pressures slightly greater than those given and especially for pipes above 18 in. in diameter, it is advantageous to place in the moulds during the tamping process hoops of ordinary wire about 6 in. apart. This permits a slightly wetter mixture and adds strength to the pipe without materially increasing the cost.

Considerable practice is necessary before satisfactory pipe can be made and many pipes will be broken before sufficient experience has been acquired.

Curing the pipe is necessary when the process of moulding is completed. The dry mixture does not contain sufficient water for the cement to crystallize

properly and additional water must be supplied by sprinkling during the curing period. The first sprinkling is done with a fine spray as soon as the pipe has set sufficiently to stand it without washing. After this the pipe must be kept continually moist by frequent sprinkling or by covering with wet burlap or sacks for a period of at least one week and not be allowed to become dry or white.

Coating the pipe to make it less pervious is usually done on the inside with a thin paste of neat cement. Some prefer to use a cement lime mixture made of 2/3 cement and 1/3 lime. The coating of the smaller sizes of pipes, 6 to 12 in. in diameter, is often obtained by dipping the pipe in the liquid. For the larger sizes of pipes the coating is applied with a fiber brush. It is preferable to do this as soon as the pipe will stand the handling, usually when it is 24 hours old, at which time the base rings can be removed. To lift the larger size pipes a lifting jacket which fits around the pipe and tightens when the pipe is lifted, is often used.

The cost of moulds varies. A good mould must be substantially made to withstand the tamping and must be easily and quickly set in position and removed. The largest manufacturer of the moulds used in southern California and supplied to the U. S. Reclamation Service for use on some of its projects is the Kellar and Thomason Company of Los Angeles, California. Their list price in California of a set of moulds for 6 in. pipe with 100 base rings is about $50; for 12 in. pipe with 100 base rings, $82.50; for 18 in. pipe with 50 base rings, $94,25; for 24 in. pipe with 25 base rings, $107.50; and other sizes in proportion.

Dimensions of Cement Pipes and Rate of Manufacturing. Cement Pipe Data.

Inside diameter of pipe in inches.	Thickness of pipe in inches.	Number of feet of pipe made with 1 bbl. cement. 1:4 mixture.	1:3 mixture.	Men composing one crew.	Number of feet made per day.
6	1 1/16	95	75	(1 mixer, 1 or)	400-500
8	1 1/4	63	50	(2 moulders,)	350-400
10	1 3/8	47	37	(1 finisher &)	300-400
12	1 1/2	36	28	(helper)	250-350
14	1 5/8	28	22	(1 or 2 mixers)	225-325
16	1 3/4	23	18	(2 moulders)	200-275
18	1 7/8	19	15	(1 finisher &)	150-225
20	1 7/8	17	14	(helper)	125-175
22	2	15	11 3/4	( )	100-150
24	2 1/4	12 1/4	10 1/2	(3 or 4 mixers)	100-150
26	2 1/4	11 1/2	9	(2 moulders)	90-120
30	2 1/2	9	7	(1 finisher &)	90-110
36	3	6 1/4	5	(helper)	80

Cost of making pipe may be obtained from the above data and the following prices of labor and material: Portland cement, $3.50 delivered on the ground; gravel, $1.00 a cu. yd.; labor, tampers, $3.00 a day, and mixers and sprinklers, $2.50 a day. The figures given include all materials and labor and an allowance of about 10 per cent for interest and depreciation on plant, administration, and supervision, and should not be exceeded with efficient workers.

Cost of Making Cement Pipes (in cents) Per Lineal Foot.

Diameter of pipe.	Cost for 1:2 mixture. (cents)	Cost for 1:3 mixture. (cents)	Cost for 1:4 mixture. (cents)
6 in.	13	10	7
8	15	12	9
10	20	15	11
12	25	20	15
14	30	25	20
16	36	30	25
18	42	35	30
20	50	43	35
24	68	60	50
26	87	75	63
30	95	85	70
36	130	115	95

ELECTRICAL TRANSMISSION FOR PANAMA CANAL.

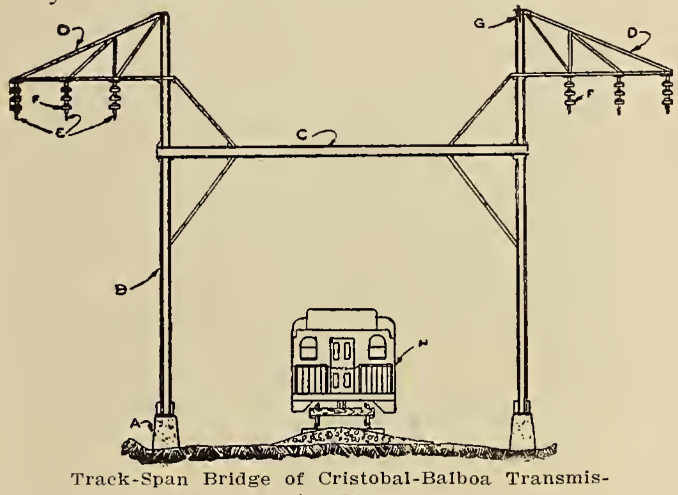
Construction work has been begun upon the permanent electrical transmission line across the Isthmus, according to the Canal Record. The transmission line is fundamentally to transmit electrical energy from a source of generation at Gatun to load centers at Miraflores, Balboa, and Cristobal. The system is simple and straightforward. At the Gatun spillway, a portion of the lake water will be passed through turbines to generate electrical energy. The energy, generated at 2200 volts, 25 cycles, three-phase, will be carried along the east wing of Gatun dam by heavy cables in duplicate underground duct-lines, and through tunnels under the locks, into a transformer substation, situated on the east side of the locks. The duct-lines are in duplicate, to insure maximum safeguard against damage in event of a burn-out of a cable in one or the other of the lines, and are to be laid approximately 600 ft. apart.

At the Gatun substation, which is to be situated at the north end of the hill upon which the present Atlantic Division office building stands, the electric energy will be transformed from 2200 volts to 44,000 volts by means of step-up transformers. The equipment, in addition to three 2000 kilowatt transformers, will consist of the necessary lightning arresters, oil switches, buses, control board, and other auxiliary appurtenances. Two high tension lines will emerge from the substation and tap into duplicate transmission lines.

The transmission line will run from Cristobal to Balboa, completely across the Isthmus, permitting distribution of energy both ways from Gatun. The line is to parallel the right-of-way of the Panama railroad for its entire length. At Cristobal and Balboa will be terminal substations similar to the Gatun substation. The terminal substations will receive the energy at 44,000 volts, less the voltage drop in the line, and step-down transformers will convert the pressure to 2200 volts, which will be the distributing voltage for all circuits. At Miraflores, a substation will be installed for supplying energy for the motors and lamps of Pedro Miguel and Miraflores Locks. If electricity is required along the line, the transmission lines will be tapped by outdoor type of transformer substation equipment. This will probably be done at Caimito, to supply electricity to the high power radio station; at Monte Lirio, to supply power to the bascule bridge, and at any permanent town or military reservation which demands electric lights and power.

At Miraflores, the present steam turbo-generators will be tied into the permanent electrical system through 2200 volt tie-lines extending to the Miraflores substation. This steam station will serve as a reserve in the event the hydroelectric station at Gatun should break down. In emergency, energy from Miraflores will be transmitted back to Gatun and to the terminal substations at Cristobal and Balboa, insuring a continuity of service on the system at all times. The present steam station at Gatun, which has been operated during the construction period, may be abandoned in a year or two if conditions warrant placing entire dependence upon the water power.

The type of transmission line which has been adopted is illustrated in the accompanying sketch. The track-span bridge supports one of the duplicate three-phase lines upon each side of the railroad tracks. Each of the three power conductors is carried from suspension insulators attached to a side bracket. The conductors are No. 00 in size, and are five feet apart and five feet from the frame. The insulators are made of vitreous porcelain, in three units, which is ample to sustain the impressed potential of 44,000 volts. The insulator fittings are made entirely of monel metal to resist climatic corrosion. A ground wire for protection against lightning is carried at the top of each side frame. The ground wire is 5/16 in. copper-clad solid wire. The copper-clad wire is being furnished with a copper sheath of nearly one-half the area of the wire, surrounding an amalgamated, carefully selected steel core.



Track-Span Bridge of Cristobal-Balboa Transmission Line.

The steel bridges are spaced on 300 foot centers, a total of 917 being required across the Isthmus. The span between side frames is 36 ft. The track-span bridge, in addition to supporting the duplicate transmission lines, admits of the suspension of a catenary trolley construction, should it prove desirable in the future to electrify the Panama railroad.

The construction adopted has several advantages for transmission purposes. By paralleling the Panama railroad, material can be brought to within a very few feet of the point of actual erection. The side bracket suspension of the conductors separates the duplicate lines so that a burn-out in one will in no manner affect the other. The conductors are outside the track and will be comparatively free from deterioration caused by smoke from the locomotives. The structure itself is fundamentally strong and is capable of easily resisting all strains introduced by breaks in the wires.

A few details of construction are worthy of note. The No. 00 copper conductors are 7-strand pure copper cables, totaling 1,500,000 ft. in length. The individual strands are manufactured without either a soldered or a welded joint. Splices in the cable will be made with soft copper sleeves. The conductors are suspended at the insulators from monel metal fittings, which are bushed with a copper sleeve. Thus, in the entire length of line, there will be no point where the copper strands are in intimate contact with a second metal; this prevents the introduction of an electric couple and consequent electrolytic deterioration.

At each track-span bridge, the ground wire will be clamped to the tower, and a positive T-connection through a copper wire will be made to ground plates buried in the earth. These ground plates are being manufactured from old scrap copper and cable which have accumulated at the Empire storehouse. By frequently grounding the ground wires, it is expected that line trouble and substation burnouts caused by lightning will be reduced to a minimum. Five hundred thousand feet of copper-clad wire are required for the two ground wires.

The insulators, which will support the conductors, are of two types, suspension and strain, each assembled of three porcelain discs, ten inches in diameter, joined by monel metal fittings. This metal is used on account of its unusual strength and its ability to resist corrosion; galvanized fittings which are customarily used in the United States and abroad are considered practically worthless in the Isthmian humidity. The strain insulator is to be used on sharp curves and for anchoring at intervals, and the suspension insulator is to be used upon tangents and light curves. The suspension insulator swings freely from the bracket, while the strain insulators take the position of the conductors and hold the conductors more rigidly to a line. Each wire requires two strain insulators per bridge on sharp curves, and one suspension insulator is required for each wire per bridge on tangents and light curves. Four thousand suspension insulators and 2500 strain insulators, have been ordered for the entire line. The total weight of the copper conductors, including the ground wires, will be approximately 400 tons.

In the design of the bridge the steel is distributed so as most efficiently to resist the maximum stresses incurred. The side frames are A-frames, to resist uprooting of the bridge in event all wires are down in one span. The crosspiece is made of two channels, which are crossbraced to carry the longitudinal pull of the catenary construction which may be attached it the railroad is electrified. The side brackets for supporting the line conductors are three-legged, designed both to support the weight and to resist the torsional pull of the wires. The brackets and the crosspiece are braced to the side frames, so that the entire bridge acts as a unit to resist side pull on sharp curves.

The type of concrete foundations for the track-span bridges has been given considerable study. The standard foundation will consist of two pedestals under the two legs of each side frame, the pedestals resting upon a spread slab, which latter is reinforced by scrap steel rails. Each leg of the side frame is to be secured to the pedestal through two 15-inch anchor bolts, which are clamped at the lower end to the steel rails in the spread slab. Provision for anchoring the foundations is made by extending downward long reinforcing rods, encased by concrete in a drilled hole, which latter has been sprung at the bottom with light charges of dynamite. This foundation should afford a thorough footing, both for the normal bearing and for anchorage to resist side pull when wires are broken.

ELECTRICAL CONDITIONS AT NAGASAKI, JAPAN.

The new plant of the Nagasaki Electric Light Company was expected to be completed in May and from June 1 would be in a position to furnish current day and night for both light and power. In March the company furnished only current for lighting at night. This company had a very prosperous year and in addition to declaring an 8 per cent dividend for 1912 carried forward net profits amounting to an additional 7 per cent.

The Nagasaki Electric Tramway Company has not as yet been able to finance its enterprise and the promoters have asked for an extension of six months in which to begin the construction work, the time limit for beginning the work having been fixed by charter for February 4, 1913. The principal promoters are Saseho and Kobe men. They have not been able to enlist Nagasaki capital to any great extent and are now trying to finance the scheme in Kobe. The capital required is about $600,000. The two suburban electric lines, one from Nagasaki to Tokitsu and the other from Nagasaki to Mogi, also have not been able to finance their projects and are waiting for the building of the city lines, their lines being intended as extensions or feeders of the city trams.

The electric railway from Sonogi in Nagasaki Prefecture to Azambara in Saga Prefecture via Ureshino and Takeo, both hot springs health resorts, and known as the Hizen Railway Company, is rapidly nearing completion and the section between Sonogi and Takeo is expected to be opened to traffic during the present summer. A cargo of fittings and machinery for this road came from the United States last spring.

The Kagoshima Electric Tramway (city) was opened to traffic December 1, 1912, and is in successful operation. The machinery is of American make.

The hydroelectric power station at Chijiwa, owned by the municipality of Chijiwa, in Nagasaki Prefecture, has been in very successful operation, and the plant will have to be enlarged to supply the demand for electric light on Shimabara Peninsula.

The large power station of the Kiushu Hydroelectric Company at Hita on the upper reaches of the Chikugo River in northern Kiushu is now in course of construction and is expected to be in operation by October 1, 1913. This plant will be capable of developing 20,000 horsepower and the promoters expect to transmit power to Moji, Kokura, and Wakamatsu on the Straits of Shimonoseki.

The Shimabara Light Steam Railway, in Nagasaki Prefecture, was very successful in 1912, and the extension of the line is being pushed rapidly. The second section of the road between Aino and Kojiro, a distance of 8 miles, was opened to traffic October 4, 1912, and it was expected that the section from Kojiro to the town of Shimabara would be opened to traffic about June 1, 1913. This road when completed will afford one of the most picturesque trips in this part of Japan, traversing a very fine rice country, skirting the coast of Shimabara Gulf, and running along the foot of Unzen Mountain, an extinct volcano rising from the waters of Shimabara Gulf. A large Japanese-style hotel is now building at the Shimabara terminus of the road to accommodate the expected Japanese tourist travel to the mountain, which is famous for its hot springs and scenic attractions.

SEATTLE'S ELECTRICAL PAGEANT.

One of the most brilliant Electrical Pageants held on the Pacific Coast was given by the Tilikums of Elttaes on the evenings of July 16th and 19th to celebrate the opening and closing of the Potlatch Carnival at Seattle, Washington. There were fourteen floats in the pageant, representing Comet, Hyas Tyee, The Eagle, Grotto, Submarine, Tilikums, Drill Team, Shasta Daisies, Indian Canoe, Summer Float, Flying Birds in Cloudland, Wild Demon, Bear, Gold Bug and Indian Basket, a picture of which is shown, as indicating the elaborateness of the display.

Floats—Indian Basket, Typifying Indian Life.

Accompanying the floats were many Tilikums costumed as bears, eagles, frogs, ravens, different bugs and Indians. The first drill team wore hats illuminated with six lamps each, and executed many fancy maneuverings. The second drill team headed a body of three hundred marching Tilikums, each wearing above his hat an electrically illuminated swinging lantern with a Potlatch Bug on each side.

It is estimated that 200,000 people viewed this parade on the first night, and much praise was heard on all sides for the enthusiastic spirit shown by the Tilikums in presenting so gorgeous a spectacle. The name "Tilikums of Elttaes" is the Indian phraseology for "Friends of Seattle" and that body now has upon its roll the names of twenty-seven hundred members. The electrical pageant cost over $10,000 in actual expenditures in addition to the large amount of work gladly given by the members of the Tilikum Lodge in its preparation. The floats were designed by Miss E. L. Mulkey; and the electrical features and general supervision of the work was under H. Joslyn, chairman of the Pageant Committee.

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Creating New Business

The fact is being continually more forcibly impressed upon the minds of business men in the electrical industry that success is to be gained not so much by alertness in competition or by the power of monopoly as by the actual creation of an increased demand for electrical apparatus. For a company to merely serve existing consumers is not sufficient. Electrical merchandizing, excepting the product of the central station, differs from most other kinds of business, in that there is little or no "come-back." Most of the generating apparatus, as well as the transmission and distribution equipment, has a depreciation of less than ten per cent. An electrical contractor can look for little new work in a building which was adequately wired when erected. Electrical devices for industrial and domestic use, with the exception of lamps, have long life and are seldom renewed. Electrical supplies in general are not consumed as are food and clothing. More business must be new business. The electrical industry can continue only by expansion.

In the past the natural growth has been phenomenal and has severely taxed the capacity of all manufacturers to meet the regular demands. Today the electrical industry represents an investment of ten billion dollars. The central station industry alone, is doubling its earnings and investments every five years, growing twice as fast as the country itself. Some of the Pacific Coast companies are annually earning better than twenty dollars per capita. Yet the business has not kept pace with the possibilities which have been opened up by science, nor has the efficiency of selling been fully developed.

To still further accelerate this rapid growth a concerted, aggressive effort of co-operatiive endeavor is being launched by the Society for Electrical Development. Positive methods are to be employed in getting every man, woman and child in the country to "do it electrically," a habit which, once formed, should never be broken. The people are to be taught by general educational publicity how indispensable electricity is in every walk of life. As such a co-operative campaign has already proved most effective in creating and extending the sale of electric lamps, as well as of electric vehicles, its success seems assured if proper support is received from individual electric companies.

A Defense of Pure Science

Pure science, long scorned alike by business man and classical student, has finally come to its own through the marvellous results attained in the research laboratory. The man of money admits the inadequacy of "the rule of thumb" and the man of letters confesses the inability of "the humanities" to accomplish for human service what has been done by science. Working for the sheer love of it, without thought of reward, the scientist is making possible a bigger business and a finer literature than the world has yet known.

Business will be dependent upon science for much of its future development. Many a profitable indus-

try has been, and is yet to be founded upon science for science' sake. The dye works of Germany, the electro-chemical plants of Niagara, the nitrate factories of Norway, are but the forerunners of a substantial prosperity to be reared upon the stable basis of scientific investigation. In order that these beneficial results may be the more speedily accomplished business men and governments are endowing research laboratories, realizing that such investments will compound themselves many times.

Literature, also, must yield to science its claim as the supreme product of constructive imagination, the greatest of human powers. The scientific imagination of the nineteenth century was more productive in human advancement than all the literary imagination of the preceding eighteen. A mere language, such as Greek or Latin, has no inherent value as a humanity beyond its power as a vehicle to convey inspiring thoughts. Writing is great in proportion to the greatness of its theme. Literature is classed as a humanity because it chronicles great deeds. Is not the conquest of nature more worthy of record than the conquest of a nation? Is not the constructive imagination which conceived the subjugation of the untamed energies of the mountain torrent by trestled flume and impulse wheel greater than that which put a barbaric race under the yoke? The instantaneous delivery of electric power to distant cities, the wireless transmission of thought across pathless seas, surpass the most extravagant dreams of the ancient writers. Newton, Faraday and Maxwell were greater humanists than Alexander, Caesar and Napoleon. A mathematical formula may involve a higher degree of constructive imagination than a poem. The brilliant discoveries as well as the patient labors of the men of genius who have developed modern science are as great in their inspiration for prose or poetry as the deeds of valiant warriors or intriguing courtiers.

Woodrow Wilson has said "character is a by-product, it comes, whether you will or not, as a consequence of a life devoted to the nearest duty." Thus it is that the scientist as a man of the highest character is worthy of visualization by the most able writers. Furthermore, art is so deeply indebted to the scientist for such instruments as the camera and the phonograph, which have so extended her influence and life by forever fixing the deleble, that the obligation can be repaid only by recognition.

Discord Among the Contractors

Notwitstanding the spirit of co-operation which pervades the several branches of the electrical business there still remains a lack of harmony between the individual members of some of the branches. Particularly is this true among the Pacific Coast electrical contractors. Destructive competition at Seattle and Los Angeles, a factional strike at Portland and the formation of a new association at San Francisco are only the external evidences of an underlying spirit of unrest. While it is better for bodily impurities to break out as boils than to remain as active poisons in the blood, their appearance is indicative of a condition which needs correction.

Destructive competition in any community can be eliminated only by a slow process of education, such as that which has been undertaken by the Jovian Order. The factional fight at Portland is a reflex of the labor trouble between the Pacific Gas & Electric Company and its employees, such strikes can be obviated only by public insistence that these controversies be submitted for mediation to an unprejudiced tribunal. The new association was originally formed at San Francisco as a protest against the municipal ordinance regulating electrical construction. A possible adjustment requires more extended study.

It is claimed by nearly a hundred master electricians that San Francisco's new electrical ordinance is discriminatory in character. Without entering into a discussion of the merits of the two sides in this controversy it must be admitted that the idea of a special code for each city is fundamentally wrong when a National Code has been provided. When this is found lacking it seems better to correct it than to draw up a new code for each city with its attendant dangers of cheap work.

Investigation will show that many of the faults which the local regulations are intended to correct are due not to the code but to attempted evasions thereof. What with the restriction of rigid specifications and close competition in bidding the average contractor stands between the devil and the deep sea. It is notorious that the profits in the business come from the extras. It is unfortunate that the losses are sometimes covered by careless installation. Too low a bid brings loss not only to the bidder but also to the trade at large by lowering both prices and standards. The contractors are at fault in having accustomed the public to expect unduly low competitive bids and it has become one of the prime objects of the various associations to educate members on the subject of correct bidding principles.

Such associations in no way represent restraint of trade, but are intended to teach that prices quoted and work delivered are one and the same. Business reputation can be built only upon honest installation. These are the objects for which the old association was founded. Many contractors, particularly the larger concerns, have benefitted thereby. But there still remained a greater number, especially among the smaller contractors, who were not organized. These constitute the bulk of the new association. While there may be a few points of policy upon which the two associations differ their main interests are identical. The new association can do a great work in interesting its members in better trade conditions and eventually a coalition of the two may be accomplished, when their minor differences are bridged over and their combined energies directed to upbuilding the business.

Concession must precede co-operation. Before the two associations can be brought together mutual prejudices must be removed and each side must concede some disputed question. A thunder storm is the result of a difference of potential between two clouds; the new association is the result of a difference of opinion between two classes. After the storm has passed the atmosphere will be clearer, and if nobody gets in the way there will be no fatalities from lightning. The parched soil will be moistened and new verdure will spring up. Let there be harmony.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

I. W. Anderson, president of the Oregon-Washington Corporation, Portland, was in Seattle last week.

O. W. Lacey, of the H. C. Lacey Company, Hanford, was a visitor in San Francisco the first part of the week.

H. H. Anderson, salesman Seattle office Pacific States Electric Company, is spending his vacation at Calgary, Alta.

H. L. Bleecker, a vice-president of the Washington Water Power Company, has returned to Spokane, Wash., from California.

F. H. Leggett, manager of the Western Electric Company, San Francisco, left this week for a several days' trip to Los Angeles and the south.

O. L. Cowart, salesman for the General Electric Company in the Alaska territory. has returned to Alaska after a short business trip to Seattle.

W. E. Ayden, assistant treasurer, Seattle office Pacific States Electric Company, is spending his vacation at Lake Crescent, Washington.

Geo. Campbell, general manager of the Truckee River General Electric Company, Truckee, Cal., spent the first part of the week in San Francisco.

P. H. Affolter, chief electrical engineer Fairbank, Morse Company's San Francisco office, was in Eureka this week on business for the company.

H. S. Jones, motor salesman Allis-Chalmers Manufacturing Company's San Francisco office, returned this week from a pleasant vacation at Lake Independence.

W. D. Ludwig, formerly treasurer of the Tacoma Electric Machinery Company, has succeeded J. W. Holmes as manager, Mr. Holmes retiring from the business.

A. E. Drendell, president of the Drendell Electric & Manufacturing Company of San Francisco, is enjoying a month's hunting trip in the big redwoods of California.

L. S. Nicholson, sales manager Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is making a trip through the northwest in the interest of his company.

D. I. Gallivan, San Francisco manager of the Newbery Bendheim Electric Company, has left for a three weeks' vacation and hunting trip through Mendocino county, Cal.

F. L. Webster, manager San Francisco branch Allis-Chalmers Manufacturing Company, spent several days in the northern part of the state this week in the interests of the company.

J. A. Reardan, of the Reardan Electric Company, Seattle, is making a business trip to San Francisco and upon his return will go to Vancouver and Victoria, B. C., on a similar mission.

A. A. Miller, manager railway and lighting division, Seattle office, Westinghouse Electric & Manufacturing Company, has returned from a ten-day business trip through eastern Washington, and western Montana.

J. L. Casey, purchasing agent, Seattle office Pacific States Electric Company, was married July 28 to Miss Lillian Knowles of Seattle. Mr. Casey was the recipient of a handsome silver dinner set by the other employes.

Henry Kammerer, electrical engineer for the American-Hawaiian Sugar Company at Crockett, who is also superintending the electric street decorations for the coming Native Sons' celebration, was in San Francisco during the week.

Col. Geo. W. Goethals, chairman of the Isthmian Canal Commission and chief engineer of the Panama Canal, has accepted the honorary presidency of the International Engineering Congress and will preside in person over the general sessions to be held in San Francisco, Sept, 20-25, 1915.

H. S. Graves, Chief United States Forester, was at San Francisco this week en route to Washington, D. C. Mr. Graves spent several weeks in the Pacific Northwest and reports that the present policy of the Forestry Bureau will undoubtedly aid the development of our great natural resources.

Dr. Thos. Addison, of the General Electric Company, San Francisco, has called a meeting of the local office managers and general officials of the Pacific Coast district for Del Monte, August 1 and 2. Among those in attendance will be T. E. Bibbins, S. E. Kearney, W. J. Davis, J. A. Cranston, R. J. Cash.

W. L. R. Emmett, engineer in the turbine department of the General Electric Company, Schenectady, arrived in San Francisco, and expects to make an indefinite stay on the coast. He will be present at the trial trips of the U. S. collier Jupiter, having designed the turbo-electric propulsion installation of that vessel.

F. E. Pernot, at present connected with the experimental department of the Pacific Telephone & Telegraph Company, has been elected an instructor in electrical engineering at the University of California. Mr. Pernot took the degree of Master of Science from California last year. He is now actively engaged in the inductive interference tests being conducted by the power and telephone companies in this state, and will take up his new work next month.

Artuhr P. Davis, chief engineer for the U. S. Reclamation Service, has returned to California from a trip to Alaska made for F. G. Baum & Company, who are consulting engineers for the Alaska Gastineau Mining Company in the construction of a concrete dam of the Jorgensen variable radius arch type. The height of the dam is to be 168 ft. with a maximum thickness of 47.5 ft., the total yardage being about 50,000. Work on the dam and power project is progressing rapidly.

Prof. Michael J. Golden, for thirty years the head of the Practical Mechanics Department of Purdue University, Lafayette, Indiana, is at San Francisco visiting his sister Dr. A. W. Bidding, who is connected with the food laboratory of the United States Department of Agriculture. Prof. Goldens' faithful service at Purdue has won him many friends, and those in California are welcoming him on his first visit to the Coast. He will attend the Bohemian "Jinks" to be held soon in Bohemian Grove.

John G. Williams has been appointed assistant superintendent of street railway service of the Utah Light & Railway Company, to fill the vacancy occasioned by the promotion of George W. Manning into the superintendency. Mr. Williams is an old time street railway man and began his service in Salt Lake City as motorman on the Murray line of the old Rapid Transit Company, under Mr. Cameron. His long service with the company and experience in handling the public admirably fit him for the position.

H. T. Cory, consulting engineer, San Francisco, who returned last week from an extensive trip in the East, has been highly honored by having presented to him the Fuertes gold medal from Cornell University. This medal was founded by the late Prof. E. A. Fuertes, for many years Dean of the College of Civil Engineering at Cornell, and is awarded each year to an alumnus of Cornell for meritorious research work. Mr. Cory, who received the degree of M. C. E. from Cornell in 1893, received the medal on account of research work done in hydraulics.

Julian Bamberger, vice-president of the Salt Lake & Ogden Railway Company, has returned home from a seven weeks' trip east, during which time he made a thorough study of the development of interurban lines centering about Philadelphia, New York, Buffalo, Cleveland, Detroit, and Chicago. Mr. Bamberger spent most of his time in the shops of the big interurban systems with a view of keeping things

up-to-date in their Salt Lake shops. He also investigated the terminal arrangements of eastern routes with a view of developing their city terminal proposition in Salt Lake City. While away he attended the convention of the master car builders and master mechanics at Atlantic City.

MEETING NOTICES.

Electrical Development League of Alameda County.

The regular monthly meeting of the Electrical Development League of Alameda county was held at the Hotel Oakland, Oakland, July 26th. A general discussion was held on Signs, Windows and Street Lighting as well as the general procedure of the City Electrical Department. J. H. Vandegrift, presided, having recently returned from an Eastern trip.

Oregon Society of Engineers.

The following permanent committees have been appointed by the president: Legislative Committee: E. H. McAlister, L. F. Harzaa, J. A. Fouilhaux, J. H. Morton and M. F. Harrison. Public Relations Committee: Robt. G. Dieck, chairman, other members to be appointed by chairman; Greater Portland Plans Committee: Wm. S. Turner, Charles F. Fisher and Hudson B. Hastings. Higher Curricula Committee: D. C. Henny, J. C. Streng and Henry Blood.

ILLUMINATING ENGINEERING SOCIETY CONVENTION.

The annual convention of the Illuminating Engineering Society will be held in Pittsburgh, September 22d to 26th. The papers committee advises the following papers have been secured: "The Use of the Photo-Electrical Cell in Photometry," by Prof. T. R. Richtmeyer of the Department of Physics, Cornell University; "Characteristics of Enclosing Glassware," by V. R. Lansingh; "The Quartz Mercury Vapor Lamp and Its Applications," by W. A. D. Evans of the Cooper Hewitt Electric Company; "The Fontune Lamp as a Working Standard," by Messrs. E. G. Crittenden and A. H. Taylor of the Bureau or Standards, Washington, D. C.; "The Neon Tube Lamp," by M. Georges Claude of Boulogne, France. In addition to these, Mr. Roscoe Scott of the Nelite Works of the General Electric Company, Cleveland, Ohio, will deliver a lecture on the "Evolution of Illuminants."

ELECTRIC PARADE TO HONOR WIZARD OF THE WASATCH.

The Wards of the Wizard of the Wasatch, Salt Lake City, Utah, are planning a spectacular electrical parade for the evening of August 31st, which is the final day of the celebration in honor of the visit of the Wizard of the Wasatch — a carnival which it is planned to hold annually to typify the progress of the state in its agricultural, mining, industrial and social activities. The Utah Light & Railway Company have proffered the use of their Second East Street car barn now vacant, and Don J. Eaton who has been appointed Superintendent of Construction, is now busily engaged in the preparation of the floats, the designs for which have been chosen.

NEWS OF OREGON RAILROAD COMMISSION.

The commission has served notice on the various public utilities located within the state to appear before the commission at Salem, Ore., on August 12thr, and defend their practices of constructing telegraph, telephone, signal, trolley and power lines within the state with the object of determining whether the practices of these utilities are just, reasonable and safe.

The commission in its decision of the case of the Home Independent Telephone Company against the Eastern Oregon Co-operative Telephone Company, found that the rates of the independent company are insufficient to provide for the upkeep of the plant, or to pay fixed charges, and fixed new rates, such as are held to be necessary for continued operation of the plant. This establishes the principle that "cut-throat" competition will not be permitted to such extent that one company will be permitted to fix rates lower than are necessary for operation. Two other important principles were announced in relation to the practices of public utilities, recently brought under the jurisdiction of the railroad commission. One is that stockholders cannot be allowed preferential rates and the other ruling is that patrons owning facilities may be paid a reasonable rental for the equipment they own, though they may not be allowed special rates or rebates. The new rates established are $2.50 per month, individual service, business; $2 for party lines, business; $1.75 for individual service, residence; $1.25 for party lines, residence; this rental to include privilege of free use of all the company's lines in Union county for conversations limited to four minutes, to all subscribers, if the company so elects.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

Santa Barbara Gas & Electric Company has been given authority to issue bonds in the sum of $100,000, to be used for making extensions to the company's gas plant in the city of Santa Barbara.

The commission has rendered a decision denying the application of the San Diego Consolidated Gas & Electric Company to issue 3148 shares of its common capital stock of the par value of $314,800. The corporation applied for authority to issue the stock to pay the discount upon its bonds issued since March, 1909.

The Home Telephone Company of Covina has applied to the commission for authority to issue $40,000 of bonds, and to use the proceeds for building an exchange at Puente and for extending and enlarging its system in the localities in which it operates.

The Citrus Belt Gas Company, San Bernardino, has applied to the commission asking that it extend the effective date of its recent order authorizing the issue of stock and bonds for a period of 12 months.

The Saratoga Telephone Company and the Pacific Telephone & Telegraph Company have applied for an order authorizing the latter to purchase the property of the former for $3000.

Authority has been granted to the Pacific Telephone & Telegraph Company to withdraw from territory in and about Compton. The Consolidated Utilities Company to withdraw its telephone service, also is authorized from the territory in and adjacent to Watts station, Los Angeles county. The commission authorizes the companies to enter into an agreement under which telephone service will be provided for the communities concerned.

NEW CATALOGUES.

Catalogue No. 28 from the Hemingray Glass Company illustrates and describes their line of Standard Glass Insulators in a most attractive manner. A phantom half-tone and a line drawing of each style of insulator is shown, together with specifications as to weight and package quantity. Several illustrations of high voltage tests are also shown.

The General Electric Company has issued Bulletin No. A4123, describing Automatic Voltage Regulators for the regulation of generator voltage. Bulletin No. A4127 describes a Straight and Automatic Air Brake Equipment for use on either single cars or trains of three or more. Cars provided with this equipment may be used as locomotives for switching service, and for operating interchangeably with steam railroad cars. Bulletin No. A4121 is a revision of the company's bulletin on Direct Current Motors of the commutating pole design.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

NEW ELECTRICAL ORDINANCE FOR SAN FRANCISCO.

(Continued.)

Sec. M. All electrical wires hereafter installed in or on all dwellings and flats as the same are now or may hereafter be defined in the building law of the city and county of San Francisco, shall be installed by means of porcelain knobs and bushings, except main service wires, which must be installed and enclosed in rigid iron conduits, provided however, nothing in this section shall be so construed as conduits or other armor, excepting that approved cutouts or in any way preventing the enclosing of all wires in iron fuses must be provided where such wires enter or leave buildings.

Sec. N. Nothing in the ordinance shall be so construed as in any way to regulate the installation of any wires, appliances, construction or equipment of any telephone, telegraph, district messenger, call bell systems, or the connecting or disconnecting of any current measuring device, and the same are hereby exempted from any of the foregoing provisions.

Sec. O. Every corporation, co-partnership, association, or individual, or agent thereof, placing or installing electrical wires, appliances, apparatus, construction or equipment in, on or about any building, or other structure, in the city and county of San Francisco, shall, before a certificate of inspection, as provided for in Section S of this Ordinance, is issued by the department of electricity for the said city and county, pay to the department of electriciy for such inspection the following fees, viz:

For each outlet at which current is controlled or issued for four lights or under	$0.05
For each outlet at which current is controlled or is used for over four lights	0.10
For one arc lamp	0.50
For each additional arc lamp	0.25
For each motor of 1 horsepower or less	0.50
For each motor of more than 1 horsepower and not more than 3 horsepower	1.00
For each motor of more than 3 horsepower and not more than 8 horsepower	1.50
For each motor of more than 8 horsepower and not more than 15 horsepower	2.00
For each generator of 1 kilowatt or less	0.50
For each motor or more than 15 horsepower	2.50
For each generator of more than 1 kilowatt and not more than 3 kilowatts	1.00
For each generator of more than 3 kilowatts and not more than 8 kilowatts	1.50
For each generator of more than 8 kilowatts and not more than 15 kilowatts	2.00
For each generator of more than 15 kilowatts	2.50

Provided, however, as a minimum, the total amount of any bill of fees to be charged shall not be less than fifty (50) cents.

Sec. P. When any corporation, co-partnership, association or individual, or agent thereof, after notice has been given in writing by the chief of the department of electricity, shall be found to have intentionally or negligently violated any of the rules or regulations, established under this ordinance; or when, through any such violation, by corporation, co-partnership, association or individual, or agent thereof, doing the work, it is necessary to make extra inspection of the work, there shall be charged said corporation, co-partnership, association or individual, or agent thereof, for such extra inspection made necessary on account of such violation a fee of not to exceed seventy-five (75) cents per hour for the time actually consumed by each inspector making such inspection, and for the inspection of electrical wires, appliances, apparatus, construction or equipment, for which no fee is herein prescribed, and for the inspection of temporary installation for decorative advertising, theatrical or similar purposes there shall be charged to and paid by the corporation, co-partnership, association or individual, or agent thereof, installing such work, a fee not exceeding seventy-five (75) cents per hour for the time actually consumed by each inspector making such inspection, previous to obtaining the necessary certificate of inspection as aforesaid.

Section Q. It shall be the duty of the chief of the department of Electricity to turn all moneys received under this ordinance into the treasury of the city and county of San Francisco.

Sec. R. This ordinance shall not be construed to relieve from or lessen the responsibility of any person owning, operating on installing any electrical wires, appliances, apparatus, construction or equipment for damages to any one injured by any defect therein nor shall the city and county, or any agent thereof, be held as assuming any such liability by reason of the inspection authorized herein or the certificate of inspection issued by the department of electricity.

Section S. Upon completion of the wiring of any building it shall be the duty of the corporation, co-partnership or individual doing the same to notify the chief of the department of electricity, who shall at once inspect the same, and if approved by him shall issue a certificate of satisfactory inspection, which shall contain the date of such inspection and an outline of such examination; nor shall current be turned on such installation until said certificate or extension be issued; or shall any change, alteration or extension be made in the wiring of the building after inspection without notifying the said chief and securing a permit thereof.

Sec. T. Any person, firm, company or corporation that violated, disobeys, omits, neglects or refuses to comply with, or that resists or opposes the execution of any of the provisions of this ordinance, shall be guilty of a misdemeanor and upon conviction thereof shall be punished by a fine not exceeding five hundred (500) dollars, or by imprisonment for not more than six (6) days or by both such fine and imprisonment; and every person, firm, company or corporation can be deemed guilty of a separate offense for every day such violation, disobedience, omission, neglect or refusal shall continue, and shall be subject to the penalty imposed by the section for each and every separate offense.

Sec. U. The following sections of ordinance No. 1008 are hereby repealed: Section 270, Section 271, Section 272, Section 273. Section 274, Section 275, Section 276, Section 277.

Sec. V. This ordinance shall take effect and be in force from and after passage.

N. B.—This ordinance is not to be made effective until January 1, 1914, because of certain objections raised since it was passed.

(Concluded.)

PORTLAND ELECTRIC ORDINANCE.

The electric sign ordinance of Portland, Oregon, has been amended to allow "lens signs" to be installed. Also the license cost is to be based upon a charge of 10 cents per square foot for all electric signs suspended over the sidewalks of the city.

NEWS OF ELECTRICAL CONTRACTORS.

The W. H. Smith Electric Engineering Company is installing the electrical equipment in the Elks theater, in Roseburg, Oregon.

The Gamewell Fire Alarm Telegraph Company, Seattle branch, has a contract to install a 10-box fire alarm system for the city af Nanaimo, B. C.

The Pacific Coast Electric Company has obtained the electrical contract for the new Turnverein Hall, Twelfth and Main streets, Portland, Oregon.

S. W. Bailey & Company, Seattle, have just completed installation of electrical equipment in the new three-story home of the Volunteers of America near Ravenna Park.

Herbert C. Moss, illuminating engineer, Seattle, has revised the electrical plans for the Seattle branch of the Ford Manufacturing Company plant. Bids are now being received on same.

C. H. E. Williams, electrical engineer and contractor, Seattle, is installing the electrical equipment in the four-story warehouse of Sylvester Brothers at Fourth South and Vermont streets.

The Pacific Fire Extinguisher Company, Portland, has obtained the electrical contract for the new factory being built by the Ford Motor Car Company at Division and East Eleventh streets.

The electrical contract for the new apartment house belonging to Dr. W. L. Wood, located on the northwest corner of Tenth and Hall streets, Portland, has been awarded to the C. K. Claggett Electric Company.

The Salt Lake City Fire Department is installing 105 new Gamewell keyless fire alarm boxes to take the place of the old key boxes which have caused so much inconvenience. Forty of these boxes will be in the business district.

The Monarch Oil Company, San Francisco, has recently abandoned its isolated plant in favor of central station service. A complete change of equipment from direct to alternating current was made. All installations were made by the Mechanical Installation Company.

The Decker Electrical Construction Company, San Francisco, has been awarded the electrical contract for the Marine Hospital for approximately $3000. The electrical contract for the Hotel St. Francis Annex, San Francisco, has been awarded to Harry S. Tittle, electrical contractor, at a price of $12,545.

The Hill Hydraulic Machinery Company, Seattle, recently installed a 12-inch ram for Fred R. Hawn, near Grandview, Washington, pumping 110 feet above the canal. This is the second unit installed for irrigating 200 acres of land. The company has also furnished Contractor C. D. Walter for installation at North Prosser, Washington, a 9-inch ram with a 60 foot lift.

The Mechanical Installation Company, San Francisco, has recently installed at Crystal Springs for the Spring Valley Water Company, a 400 h.p. and two 500 h.p. General Electric motors, the latter being connected to a Byron Jackson pump, which delivers 12,000,000 to 15,000,000 g.p.d. against a 125 ft. head. An 800 h.p. Crocker-Wheeler motor has been installed for the same company at Ravenswood, Cal.

The Issaquah & Superior Coal Mining Company Ltd., with offices at Seattle and mines in King county, has closed a contract with W. R. Hendry & Company, Seattle, for the complete installation of electrical equipment at its mines. By reason of the equipment the capacity of the mines will be increased from 200 tons to 3000 tons per day. The aggregate h.p. of the new equipment will be about 1000.

Colman & Hahn, electrical contractors and engineers, Tacoma, have been awarded the contract for installing the equipment in the Buffelen Lumber Manufacturing plant. There will be one 300 kw. engine and generator outfit, one 4-valve automatic Buckeye engine, 29 motors and other machinery to be used in connection with wood working machinery for planing mill service.

THE OUT-OF-TOWN CONTRACTOR.

Mr. T. H. Nelms of the Pacific States Electric Company, San Francisco, had occasion to visit an out of town contractor who desired assistance preparing his store during a carnival week.

The results were so favorable both the contractor and the jobber that it is sufficient evidence the effort was worth while.

Mr. Nelms' report is submitted herewith:

"I have frequently noticed that the small town merchants do not keep their stores in an up-to-date manner. The stock is not attractively displayed and the store is often dirty and in disorder. At night the windows are not lighted. This last, to me, is the most serious fault, as window lighting is the cheapest and most effective advertising. The merchant argues that window lighting is useless as there is no one on the street at night to view his display—forgetting that were his windows, as well as those of his neighbors, lighted, there would be something for the people to come out to see.

"A short time since I had occasion to visit an electric contracting establishment in a nearby town, my mission being to assist in preparing the store and windows for a fete week. I found the above mentioned conditions more or less in evidence in this store. Starting on the outside we hung an arc in front of the store. We needed rugs, furniture and silverware, etc., to dress the place in gala attire and with the standing the customer had in the town, I found no trouble in accumulating these articles.

"With a little thought and some hard work the store was soon transformed, and during the week it attracted more than its share of attention. This cannot help but bring business to the firm.

"It would seem a good idea to educate our out of town customers to keep their stores attractive and up-to-date—showing them that articles effectively displayed means more business. It costs no more to keep a store in this manner, all that is needed is a little work.

Such effort is work along the highest, broadest lines of publicity and advertising. Carried out not only in the electrical field but by merchants in all lines of business, working together, whether in a city or rural community, redounds to the ultimate benefit not only of the manufacturer, jobber, retailer but the community at large and the individual citizen.

BOOK REVIEW.

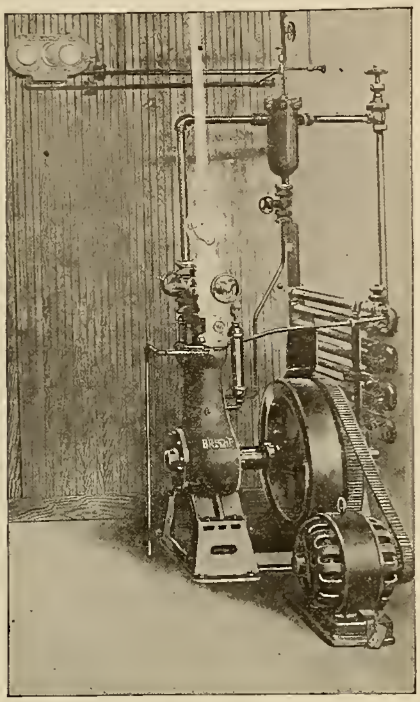
Excavating Machinery. By A. B. McDaniel; 340 pp., 6x9; 134 illustrations. Published by McGraw, Hill Book Co., and for sale by Technical Publishing Co. Price $3.00.

In this text a trained observer has brought into compact form the whole subject of machine digging devices so that the engineer and contractor as well as the farmer, landowner, or public official can determine which kind of excavator is best adapted to his needs. The work is divided into two sections, scrapers, graders and shovels occupying 100 pages, and dredges and trench excavators the balance. The arrangement of text is logical, the descriptions of machines and methods clear, the selection of cost data, judicious and the citations of practice wide in scope. A carefully compiled bibliography gives to the investigator additional sources of information if desired.

INDUSTRIAL

SMALL MOTOR DRIVEN REFRIGERATING PLANTS.

The small motor driven refrigerating plant, of which a typical example is shown in the illustration, is being used more extensively every day. Like the vacuum cleaner and the artificial ventilating system, it provides a modern and efficient means for producing results that are necessary for health and comfort.



Motor-Driven Refrigerating Machines.

The use of ice to produce cold is passing away because it is uneconomical, unsatisfactory and unsanitary. Under the best of circumstances, much ice must go to waste because of the inherent difficulties of keeping it properly. Where there is ice there must be dampness, and damp wood, sawdust, and drains are always germ laden. The temperature produced by ice cannot be easily regulated, and the maximum degree of cold that can possibly be produced is not sufficient for many purposes. Moreover, the process of filling the ice chest always creates a mess, objectionable alike to the housewife and the business man, while the ever present dampness greatly lessens the life of the refrigerator.

Mechanical refrigeration eliminates all these disadvantages. It supplies dry cold of any desired degree; the temperature produced can be readily varied to suit different purposes; and experience goes to prove that, under average conditions, mechanical refrigeration is cheaper than ice.

The electric motor permits the use of mechanical refrigeration in very small units, which need little attention and that only of the kind the average janitor is competent to give.

These outfits are being used extensively by butchers, grocers, dairymen, hotels, restaurants, public institutions, large residences, etc., for preserving food and for making ice in small quantities. Ice cream plants find them far superior to salt and ice mixture for freezing and hardening the cream. Large industrial plants use them for cooling drinking water, which is pumped to fountains in all parts of the works. The florist finds a special application for preserving flowers and preventing buds opening until wanted for sale. Modern apartment houses supply each tenant with a mechanically cooled refrigerator thus eliminating the visits of the ice man.

The cost of operating varies, of course, with conditions, the principal items of the operating expense being for power, water, oil and ammonia. The last two are small, as little oil is needed and one charge of ammonia should last a year or two.

The cost of power depends on the size of the plant, 2 h.p. per ton of refrigerating capacity being the size of motor usually recommended. The illustration shows a 10 h.p. Westinghouse motor driving a Brench refrigerating machine.

AUTOMATICALLY SWITCHING APPARATUS TO AUXILIARY SUPPLY MAINS.

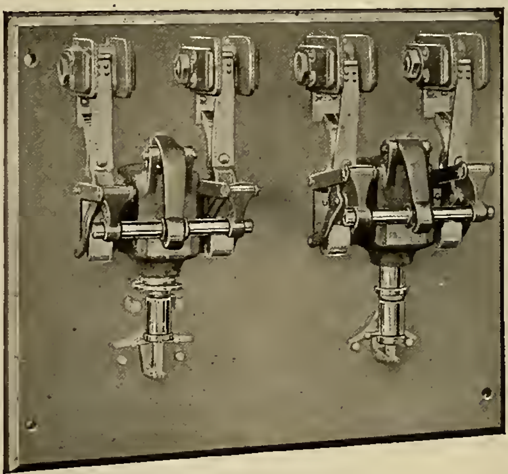
The maintenance of continuity of electric power service to electrical machinery, lighting circuits, signal apparatus, etc., make it imperative that a means be provided for switching on reserve power instantly to supply current in case of failure of the main source of power.

The circuit breaker shown in the illustration is designed for such service, and yet it is so simple in construction and in operation that it is thoroughly dependable.

It consists of two double-pole, single-coil, solenoid operated, magnetic blowout circuit breakers, each of which remains closed only while the current is on the solenoid, and drops out by gravity when this current is interrupted.

The circuit breaker on the left is in the main supply circuit and, under-normal operating conditions, is closed, while the one on the right is open.

When the main source of supply fails, the circuit breaker on the left opens owing to its solenoid being de-energized and the metallic disc directly underneath this solenoid and fastened to its core, bridges the gap between the two rectangular contacts blocks just below it as the core fails. The closing of this circuit connects the operating coil of



Automatic Circuit Breaker.

the circuit breaker on the right across a storage battery or other auxiliary source of current, and energizes its solenoid, which instantly forces the circuit breaker closed and permits current to be supplied from the auxiliary source of power, thus avoiding any interruption of service. When the regular power service is restored, the solenoid of the circuit breaker on the left is again energized, causing the circuit closing disc to be withdrawn from the rectangular contact

blocks, this action breaking the circuit of the solenoid of the circuit breaker on the right, which latter opens at once, cutting off the supply of current from the auxiliary power source.

The circuit breaker at the left of the illustration will be closed at all times except when the regular power supply fails and the apparatus must be switched on to the auxiliary source of power. The interruption due to the change from one line to the other lasts merely a fraction of a second and so operation is practically continuous regardless of the number of changes of the supply circuit. The circuit breaker described above is manufactured by the General Electric Company, Schenectady, N. Y.

THE WIRE INDUSTRY.

Statistics for the wire industry in the United States for 1909 are presented in detail in a bulletin soon to be issued by Director Harris of the Bureau of the Census, Department of Commerce. It was prepared under the supervision of Wm. M. Steuart, chief statistician for manufactures.

Of the 93 establishments in the industry in 1909, 59 drew iron and steel wire exclusively, seven drew copper wire exclusively, six drew wire from materials (chiefly brass) other than iron and steel or copper, while 21 drew wire from two or more of the metals.

Of the total cost of wire rods used by the industry as a whole, 60 per cent represented the cost of iron and steel rods, 36.3 per cent that of copper rods, and 3.8 per cent that of rods of other metals or alloys.

The wire departments of rolling mills and other concerns produced 66.7 per cent of the total tonnage of steel and iron wire and wire goods reported in 1909, and 94 per cent of the tonnage of wire and wire products of brass and other metals (except copper or alloys), but produced only 33.5 per cent of the product from copper.

The manufacture of insulated wire and cable to the value of $9,806,989 was reported by the establishments in the wire industry in 1909. Most insulated wire is made by establishments in the industry designated as "electrical machinery, apparatus, and supplies." The total value of the insulated wire and cable manufactured in 1909 was $51,624,737.

In the production of steel and iron wire, Pennsylvania led in 1909 with 851,448 tons, or 35.6 per cent of the total amount drawn. In the production of copper wire New Jersey led with 63,452 tons, or 43.1 per cent of the total; and in the manufacture of wire from brass and other metals or alloys Connecticut was far in advance of any other state, producing 32,304,963 pounds, or 92.8 per cent of the total output.

TRADE NOTES.

The Joshua Hendy Iron Works, San Francisco, are installing a 400 h.p. tangential water wheel at Elko, Nevada.

The St. Paul & Tacoma Lumber Company, Tacoma, is running two 6-ton electric locomotives equipped with Edison storage batteries.

The Gale Creek Coal Company of Wilkeson, Washington, is installing a Corliss engine, together with General Electric generator and pumps.

The Sound Manufacturing Company, Seattle, has just received a large order for steel cabinets from the local branch of the Western Electric Company.

The General Electric Company, Seattle, has secured a contract for supplying the Van Ness Lumber Company at Winlock, Washington, with a 500 kw. steam turbine with switchboard and exciters.

The Arrow Electric Company, Seattle, is installing a large electric sign on the Burke building. The cost of wiring approximates $2000. This company will shortly open a branch office at Redmond, Wash.

The General Package Manufacturing Company, Aberdeen, Washington, will install a 50 h.p. Allis-Chalmers motor. A number of motors made by this company are used in the plant which is motor driven throughout.

W. R. Hendry & Company were the low bidders on the winding drum equipment for operating the marine railway to be used in handling 75 ton boats in connection with the Salmon bay project of the Seattle port commission.

The Berkeley Electric Cooker Company, Berkeley, Cal., has received an order from the Decew Electric Company, Ltd., Winnipeg, Manitoba Province, Canada, for 100 Type C cookers. Another order for 50 cookers has been received from the H. Brown Company at Norwood.

The General Electric Company, Tacoma, is supplying the Buffelen Lumber & Manufacturing Company with a 250 kw., 440 volt., a.c., three-phase generator, direct connected to a Buckley engine. Colman & Hahn, Tacoma are making the installation.

The Portland Bronze & Crucible Steel Company, Portland, have purchased from the Westinghouse Electric & Manufacturing Company, a 300 k.v.a. oil cooled transformer and two small induction motors for use in their factory. The electric furnace will be built in Portland under French patents.

The Twin City Electric Company, Raymond, Washington, recently purchased through its New York representatives, Sanderson & Porter, one 75 kw. synchronous motor generator set and one 8 panel switchboard, all of Westinghouse Electric & Manufacturing Company make.

Meese & Gottfried Company, Pacific Coast manufacturers of transmission, elevating, conveying and screening machinery have obtained a ten-year lease on the four-story building at the corner of Mission and Annie streets, San Francisco, and will move into their new quarters this week. They will occupy the entire building.

The Tacoma Electric Machinery Company, Tacoma, announces that considerable money has been added to the business which will be greatly extended. This company has recently installed an electric crane for the Walker Cut Stone Company and has the contract for installing a second 50 h.p. variable speed motor in the Tribune building.

The Westinghouse Electric & Manufacturing Company, have recently sold to Mr. S. S. Bullis, Medford, Ore., a 200 kw., three-phase, 60 cycle, 2200 volt synchronous motor direct connected to a 600 volt interpole railway type, d.c. generator. The set is to be used on the Southern Oregon Traction Company's street railway system in Medford. This company also sold four motors aggregating 330 horsepower to the Pacific Bridge Company for their rock crushing plant at Mosier, Oregon.

The Reynolds Electric Company, Seattle, has sold to Captain Ramwell of the American Tug Boat Company a lighting plant and storage battery for his private yacht. The lighting plant will consist of a 5 h.p. direct-connected gas engine and generator 500 ampere U.S.L. battery. A sale of two direct connected Engberg lighting sets and two direct connected gasoline driven centrifugal pumps for use on tug boats was made to the American Tug Boat Company.

Charles C. Moore & Company, Seattle, have been awarded a contract by the city of Kamloops, B. C., to supply two Platt Iron Works 1100 h.p. turbine water wheels. Lombard governors and accessories. The contract for generators was awarded to the Canadian Westinghouse Electric & Manufacturing Company, and for switchboard and transformers to the Canadian General Electric Company. Charles C. Moore & Company will have charge of construction. Ducane & Dutcher of Vancouver, B. C., are consulting engineers on the job.

NEWS NOTES

INCORPORATIONS.

OAKDALE, CAL.—The Oakdale Gas Company has been incorporated for $75,000, by J. R., M. M. and C. W. Anderson.

LOS ANGELES, CAL.—Articles of incorporation for the Hanson Wireless Telephone & Telegraph Company, with a capital stock of $25,000 has been filed by C. L. Hanson, H. La V. Twiniax and L. Fall.

ILLUMINATION.

GLENDALE, CAL.—Sealed bids will be received up to August 25th for a gas franchise.

LOS ANGELES, CAL.—The board of works has approved plans for the installation of street lights in Gardena district of the city by the California Edison Company.

ANACONDA, MONT.—A resolution and petition for an ornamental lighting system in the business district was presented to the city council.

QUINCY, CAL.—The local electric light plant, owned by F. G. Gansmer, was destroyed by fire recently. Gansmer states that he will order new machinery at once and will have the plant in operation again within two or three weeks.

ANTIOCH, CAL.—The town of Antioch has filed suit against the Great Western Power Company to cancel the franchise granted it for the erection of poles along the streets of the town.

CLATCKANIE, ORE.—The electric light plant of this place has changed hands and the new management, of which W. W. Seymour is president, has undertaken to enlarge and improve the plant. An addition will be built to the powerhouse and new machinery will be put in.

VANCOUVER, WASH.—An application to the county commissioners has been presented by the Independent Electric Company for a franchise for light and power from the Clark county end of the Woodland bridge to La Center and from La Center along the Pacific Highway to Vancouver. The date of the hearing of the franchise has been set for August 6. H. G. Fleischhauer, purchasing agent of the Washington-Oregon Corporation is one of the applicants for the franchise.

SPOKANE, WASH.—Commissioner of Public Utilities C. M. Fassett presided at the first meeting of the special committee appointed by the city council to inquire into the possibility of the aquisition by purchase or condemnation of a power site on the Spokane River for a municipal lighting plant. It is estimated that it will require $1,000,000 to erect a suitable dam and purchase a power site and possibly another $1,000,000 to get the lines and conducts laid for operation in the city.

PORTLAND, ORE.—Judge Gatens has returned a decision that the 3 per cent gross earnings tax imposed on gas and electric companies by a city ordinance passed by the people June 5, 1911, is inoperative, basing his ruling on the opinion that under the old city charter, in force when the ordinance was passed, the city had no power to levy such a tax. The companies affected are the Portland Railway, Light & Power Company and the Mount Hood Railway Company, an independent corporation at the time of the passage of the ordinance, but now a subsidiary of the Portland Railway, Light & Power Company.

ELY, NEV.—It is reported that the Ely Light & Power Company will appeal from the recent ruling of the Public Service Commission of Nevada ordering a reduction in rates for light and power, and that the question will be taken to the courts for settlement. The ruling of the commission has been severely criticized by many commercial men, for the reason that they ordered the company to discontinue a readiness-to-serve form of rate and to substitute therefor a block system of rates, declaring that it was unfair and discriminatory to charge the customer with a low load factor a higher rate for energy than the customer with a high load factor.

TRANSMISSION.

BISHOP, CAL.—The Bishop Creek plants of the Nevada-California Power Company will be connected with the mining district of Bodie. Field Engineer Rhudy has begun a survey for the new line.

SEATTLE, WASH.—The Puget Sound Traction Light & Power Company has obtained franchises from the county commissioners for the placing of poles and stringing wires along the county roads to Kirkland and Redmond and over certain streets north of Eighty-fifth street. The franchise is for 50 years.

SAN FRANCISCO, CAL.—Authority has been granted by the Railroad Commission to the Pacific Gas & Electric Company to purchase ditches and water rights from the United Water & Power Company. The water rights thus acquired are to be used for the further development of the Bear River hydroelectric projects in Placer county.

BEND, ORE.—The appointment of Vernon A. Forbes of this city as one of the two House members of the Celilo Commission has been announced. This commission is empowered to act with the State Engineer in investigating the power possibilities of the Celilo Falls on the Columbia River, for which work $15,000 has been appropriated. The commission has authority to make contracts with the State of Washington and the federal government should co-operative development seem advisable.

GREAT FALLS, MONT.—The Montana Power Company is making good progress with its large projects at Thompson Falls on Clarks Fork of the Columbia River in Montana, where a 30,000 kw. power project is being developed and near Great Falls on the Missouri River, where a 60,000 kw. project is under way. At Great Falls there is a head of 80 ft. and 70 ft. dam giving a total of 150 ft. The 110,000 volt transmission line will be paralleled with the other plants of the system. Charles T. Main and Henry A. Herrick are the engineers in charge, the latter making his home at Great Falls during the construction period.

CASHMERE, WASH.—O. B. Hollis and H. H. Dickson of Spokane were here recently investigating the hydroelectric proposition of O. H. Carter, J. M. Crom, and L. H. Titchenah. They were accompanied by Jean F. Reynaud, an electrical and hydraulic engineer, who made a favorable report and a deal was closed with the owners, whereby the site and water rights were transferred to Hollis & Dickson. Development work will start within 40 days. A head of 10 ft. can be obtained by constructing a three foot dam across the river 2000 ft. above the power house. Water will be conveyed to the powerhouse by a ditch and flume. The company will be capitalized at $100,000.

TRANSPORTATION.

PITTSBURG, CAL.—The board of trustees have granted a franchise to the Oakland, Antioch & Eastern Railroad.

KLAMATH FALLS, ORE.—A meeting was held at Bonanza recently when a number of boosters from that section and from Klamath Falls gathered to discuss plans for inducing capitalists to build the Bonanza Klamath Interurban Railway.

BUTTE, MONT.—The first of the center entrance pay-as-you-enter cars were placed in operation in Butte last week. The P-A-Y-E system of collection will not be used until the company has more cars equipped.

FRESNO, CAL.—A project is on foot in Fresno for the establishment of a second street car system. The promoters have outlined routes, covering practically every portion of the city, and it is asserted that the plan is to make the new lines competitors of the Fresno Traction Company. F. F. Wright of the Fresno Home Builders, is one of the parties interested in the promotion of the new street railways.

SAN LEANDRO, CAL.—Negotiations to secure a right of way into the center of San Leandro for their suburban electric service are being conducted by the Southern Pacific Company. The line is already completed to Dutton avenue near the western limits of San Leandro, and it is the intention of the company to extend the line as far as Estudillo avenue in the center of the town as soon as a right of way can be secured.

SEATTLE, WASH.—The Seattle city council, with a view to taking over the property of the Lake Burien Railway Company, has passed a resolution directing the city comptroller to examine and check over the company's books of account and directing the engineering department and the department of public utilities to check over and verify all properties included in the rights of way of the company, the results to be transmitted to the corporation counsel.

SALT LAKE CITY, UTAH.—The scheme of pay-as-you-enter as applied to Salt Lake street car operation on South Temple street has been found to be working so satisfactorily that General Manager Joseph S. Wells of the Utah Light & Railway Company has ordered that fifty-four additional cars be made over to the P-A-Y-E type. When these are finished, all of the newer type of street cars in Salt Lake City with large enough platform will be P-A.Y.E cars.

SEATTLE, WASH.—The public utilities committee of the city council voted to recommend that an offer of $1,250,000 be made for the entire property of the Seattle, Renton & Southern Street Railway Company. This includes a double track line extending from Third avenue and Stewart street on the north, to the city of Renton on the south, a distance of nine miles, about one-half of which lies within the city limits and the other half in King county. The property was offered to the city recently for $1,400,000.

LOS ANGELES, CAL.—Expenditure of more than a half-million dollars for installation of safety devices, probably beginning a campaign which will place all of its lines under block signal system, has been outlined by the Pacific Electric Railway at a hearing of the State Railroad Commission. Plans were outlined by E. A. Roome, superintendent of telegraph, telephone and signals, under sanction of President Paul Shoup. Work is to begin at once on part of the line, from Vineyard to Venice, on Pasadena short line and the Covina line.

PORTLAND, ORE.—The Portland, Eugene & Eastern Railway Company have begun laying steel on Fourth street, where electric interurban trains are to supersede the use of steam power which the Southern Pacific Company will abandon for the more modern method of transportation. Reports from Oswego say that construction of the new power station has begun while Ralph E. Moody, general counsel for the company, filed suit at Oregon City against the Oregon Iron & Steel Company for condemnation of a right of way for the main line through the property of the steel manufacturing company.

SAN RAFAEL, CAL.—S. J. Norton of the San Rafael & San Anselmo Valley Railway, appeared before the State Railroad Commission with a petition for incorporation of the company. This new line, which will be operated as the San Rafael & San Anselmo Valley Railway Company, will run from the Puerto Suello on Petaluma avenue in San Rafael, out Fourth street to a point about half a mile westerly to Fairfax and will touch at the union station, San Rafael. The cost of the road, which will be about six miles in length, will be about $100,000, and it will take about six months to build. The company will be capitalized at $100,000, divided into 4000 shares of the par value of $25 each. Of the proposed bond issue of $100,000, $50,000 has already been disposed of. The necessary franchises through San Rafael, San Anselmo and the county of Marin have already been secured and the bonds called for by said franchises, amounting to $8000 filed. Cars will run each way daily every 20 minutes from 6 a. m. to 12 p. m. and the fare for all or any portion of the trip will be 5 cents. Beach storage battery cars will be used, requiring neither trolley nor third rail.

TELEPHONE AND TELEGRAPH.

GLENDALE, CAL.—Pacific Telephone & Telegraph Company has been granted a franchise to construct and operate a telephone and telegraph system at this place for a period of 25 years.

COLUSA, CAL.—Former Supervisor J. F. Campbell and representatives of the Colusa Telephone Company have applied to the board of supervisors of Sutter county for a franchise to erect poles and lines and maintain and operate a telephone system in that county.

RIVERSIDE, CAL.—Sealed bids will be received up to August 20th, at the office of the board of supervisors of Riverside county, for certain franchise granting right to erect or lay telegraph or telephone poles and wires, and the right to construct and maintain same for a period of 50 years.

PORTLAND, ORE.—Suit was begun here in the name of the United States against the American Telephone & Telegraph Company and its subsidiaries, charged with absorbing independent companies in order to destroy competition and create a monopoly. The attorney-general asks the court to compel the corporation to relinquish control of the Independent Telephone Company of Seattle, the Home Telephone Company of Puget Sound, the Northwestern Long Distance Telephone Company, the Interstate Consolidated Telephone Company and the Independent Long Distance Telephone Company. If necessary to accomplish the dissolution, the court is asked to appoint a receiver for the properties. An immediate injunction or restraining order is asked by the government to prevent any further steps, in pending foreclosure suits, to transfer the physical properties of the Northwestern Long Distance Telephone Company to the Bell companies.

WATERWORKS.

OLYMPIA, WASH.—This place has voted to bond in the sum of $150,000 for the purpose of constructing a municipal water system.

HOQUIAM, WASH.—A mortgage for $300,000 has been filed for the extension of the water works system. The mortgage covers between 3000 and 4000 acres of land as well as the water plant.

CULBERTSON, MONT.—A formal tender was made by Superintendent Caldwell and A. S. Huyk of the American Water & Light Company to turn over the water system to the city of Culbertson, but they failed to agree on terms.

PILOT ROCK, ORE.—Bonds for $1,200,000 were voted at an election held by the Teel Irrigation District. Engineers are at work surveying the power resources of the project. Consideration is being given to plans and specifications for the reservoir. The water will be taken from Camas and Hidaway creeks. It is thought that operation will start within the next six months.

ALPHABETICAL INDEX TO ADVERTISERS

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

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Where to Buy It in the West, Pages 9, 10. — Alphabetical Index to Advertisers, Page 8.

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You have often wished for this very thing to help you out of a "corner."

No need to wish —

Get acquainted with the line of

660 watts 250 volts

Quick Make and Break Sockets and Receptcales

Convenient, readily installed time savers.

The new key socket takes the place of the keyless socket and switch, while the quick make and break interior is so arranged it can be used either in a Multi-Catch or Fluted-Catch socket and receptacle shells.

A few other handy appliances are pictured herewith—there are many more—specially made to meet unusual situations encountered by the wire man.

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI | SAN FRANCISCO, AUGUST 9, 1913 | NUMBER 6

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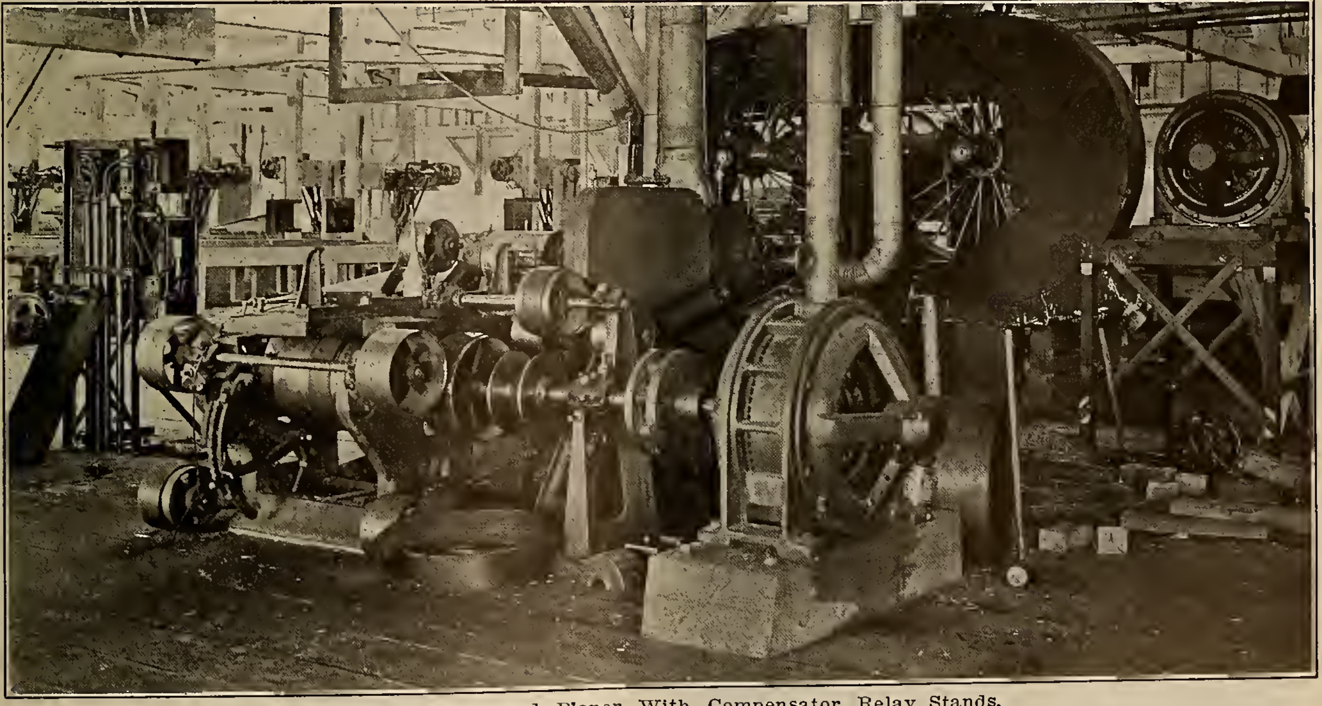
ELECTRICITY IN THE PLANING MILL

BY E. J. BARRY.

The inherent advantages of electric drive are well illustrated in the latest addition to the list of planing mills of the Pacific Coast. In June the St. Paul & Tacoma Lumber Company, of Tacoma, Washington, placed in service their new planing mill, equipped with the latest and best devices for the economical production of finished lumber. Last year their old planing mill and one of the sawmills were destroyed by fire, and it was then planned to build the best mill on the Coast. Whether this laudable ambition has been realized is left for others to judge; but there is no question that the mill is a model of its kind and reflects credit on everyone concerned from president to carpenter's helper. As may be seen from the illustrations, the mill is solidly built and is well equipped with sprinkler system and standpipes against fire. The interior is coated with whitewash as a further preventative, while the extensive blower system prevents the accumulation of shavings and sawdust, which if allowed to remain, constitute a fire risk.

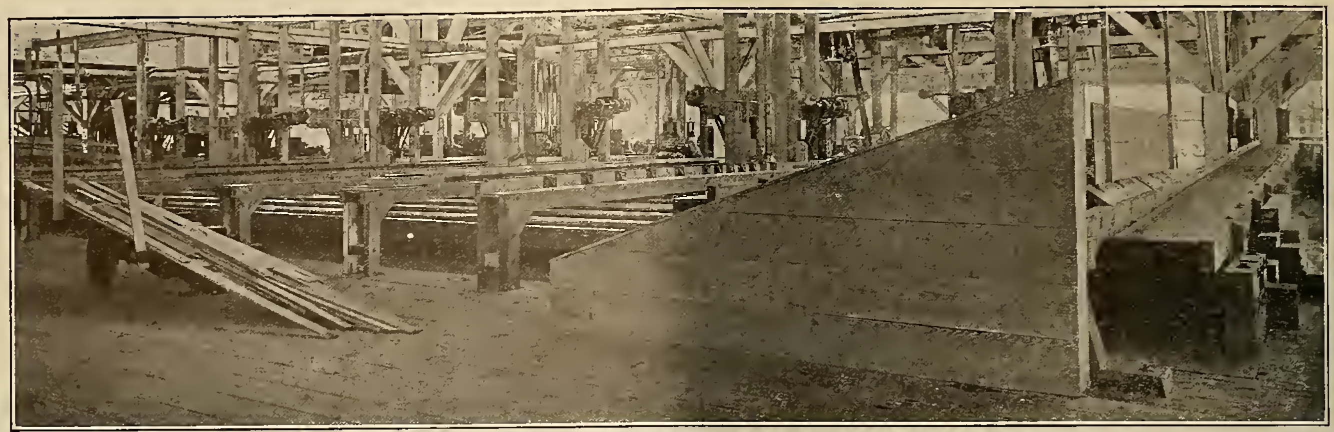
Each machine is driven by an individual motor, the absence of line shafting being highly appreciated. The total output of the planing mill is 300,000 ft. every day of ten hours, and the total connected load is 1192 h.p.

As money is made or lost in the re-handling of lumber, every effort is directed to reduce this factor to a minimum. The fast feed planers are equipped with feed tables which operate much on the principle of a repeating rifle: You load the table with boards and they are shot through the planer as fast as the machinery will operate, that is to say, up to a speed of 250 ft. per minute.



Combined Resaw and Planer With Compensator Relay Stands.

The paving block machine is the first on entering from the south end of the mill, and is driven by a 75 h.p. motor. There are 15 saws of 25 in. diameter mounted on the arbor, spaced 4 in. apart. A conveyor driven by the same motor carries the block material past the saws, and they emerge as blocks on the other side. The blocks drop into a conveyor which loads steel cages mounted on wheels, and the cages are then transferred by electric locomotives to the creosoting



Trim Saws With Individual Motor Drive.

department, and after treatment there, are ready for shipment. The capacity of this machine per day is from 75,000 to 100,000 blocks.

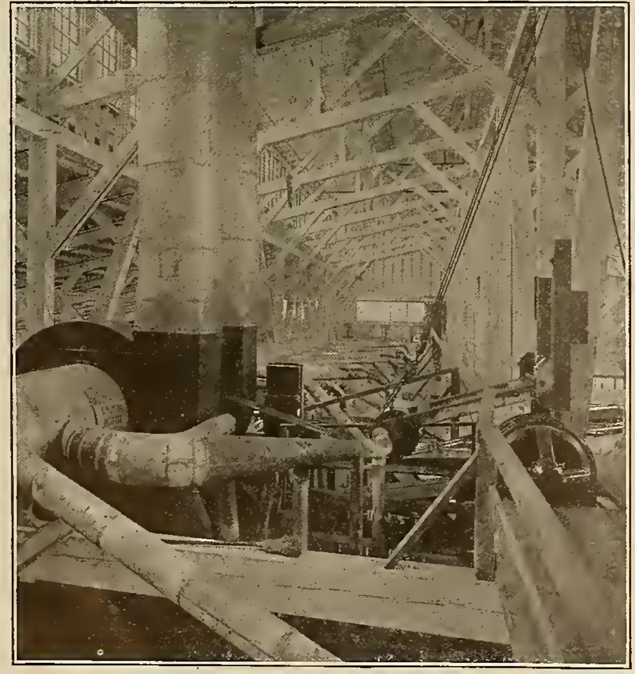
The next machine is a 20 x 16 in. Berlin surfacer; that is to say, it is capable of handling timbers of this size. A 50 h.p., 1200 r.p.m. motor is used to drive this machine. Heavy timbers for building constructions are surfaced by this machine. A 15 h.p. motor drives the rip saw next to the surfacer; the rip saw gets through a lot of work in a day.

A Fay & Egan gattling gun moulder is the next in line, turning out mouldings; 20 h.p. is required for this operation.

Following is a No. 108 Berlin moulder for heavier material, taking a motor of 35 h.p.

A 64 in, resaw driven by a 50 h.p. motor resaws lumber to required thicknesses; an indispensable machine for planing mill work.

The next machine is a combined resaw and planer, as shown in illustration, and while rather a novelty on the coast, has done good work elsewhere. Here,



Blower System for Removing Shavings.

as in all industries where it is possible to combine two operations in one, the cost of production is cheapened to that extent. Various kinds of lumber call for surfacing on one side only, so the material is planed top to bottom, and is resawn as it passes out of the machine.

A 50 h.p. motor is used for the planer, and a like one for the resaw. The motor for the planer is direct connected, but a silent chain drive is used on the resaw to allow a 2½ in. movement of the heads.

The relays of each motor are connected in series so that a mishap to one will throw the other out. This to prevent the planer driving lumber at full speed against the saw when its motor has stopped.

Two 15 in x 6 Berlin planers follow, driven by 75 h.p., 1200 r.p.m. motors.

Next in line is a 9 x 6 Berlin Machine driven by a 50 h.p. motor, and following respectively a Fay & Egan planer and a S. A. Woods planer, both 15 x 6 and driven by 50 h. p., 1200 r.p.m. motors.

Attached to each of these five machines and driven by an individual 15 h.p. motor, are profilers to cut various grooves and beadings in the finished lumber.

As the lumber passes through the planers it is trimmed to the proper lengths by small swing saws, of which there are sixteen, each driven by a 3 h.p. motor. These are shown in the illustration.

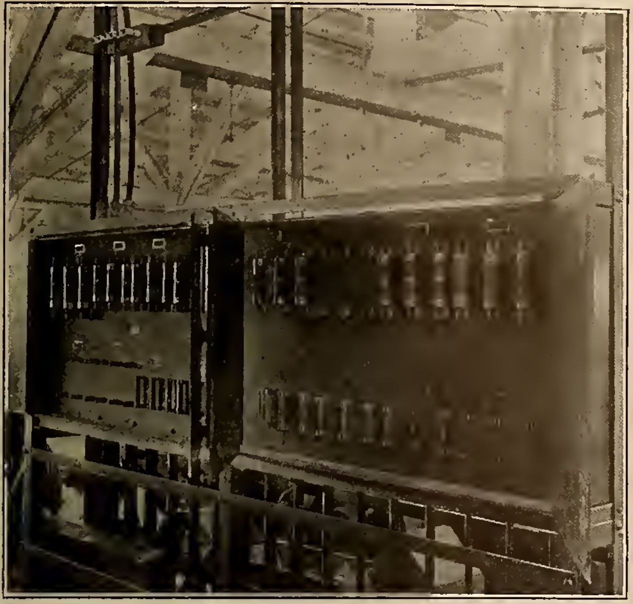
The cuttings from the trim saws drop down a chute into a motor driven conveyor which carries them to a hopper outside the mill, for disposal. The lumber, cut to proper dimensions, drops on a revolving belt conveyor, and is taken to the grading table. After sorting, it is loaded on small cars, ready for rail or water shipment.

The blower system is driven by two 150 h.p. motors, and a suction pipe is brought to every machine.

The wiring throughout, both for power and lighting, is installed in galvanized conduits, with the object of securing fireproof and mechanically and electrically sound construction. A temporary service is obtained from the local Tacoma Railway & Power Company, but a 1000 kw. General Electric Curtis turbo generator has been installed and will be placed in operation as soon as possible. The mill refuse must be destroyed, and use will be made of the steam generated and now going to waste.

The service is brought in at the south end of the mill, and consists of four 350,000 c.m. rubber-covered cables arranged in multiple, twelve cables in all. The conduit is carried under the floor wherever possible, and care has been taken to install it with a view to appearance as well as utility.

The main feeders supply two panel cabinets designed by the writer and built by Evans-Dickson Company, of Tacoma. The bus bars are accessible from the rear, leaving the fuse mountings in the front of the panel clear of cables. In operation, the doors at front and back of cabinets are kept closed, and the insides of doors are lined with asbestos over the steel to prevent arcing trouble, should by any means a fuse be jarred loose. The fuses are readily accessible to cut a circuit out of service, should such be necessary, without in any way interfering with the operation of other machines.


Front View of Distributing Panel.

A majority of the motors used throughout are the General Electric Company's type K.

Overload relays are used throughout instead of fuses in the running position, and the writer is a firm believer in the use of relays for motor protection. One can tell at a glance if a relay has been tampered with, but a refilled fuse of heavy capacity can easily give fancied protection.

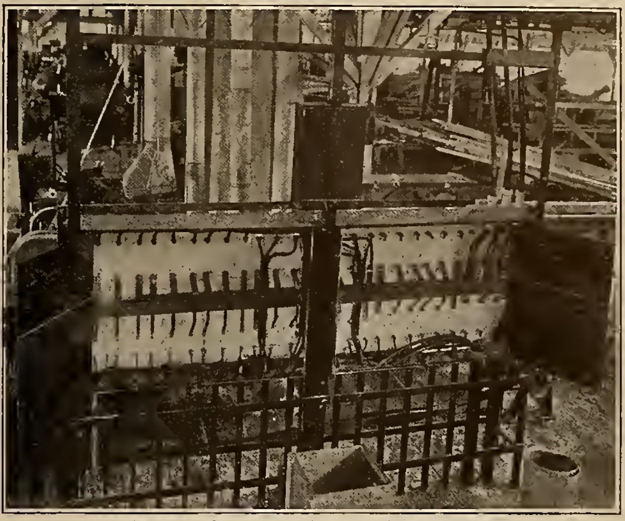
The annoyance of a motor continually dropping out will soon cause the operator to report to someone in authority and give the opportunity perhaps to prevent serious injury to the machine as well as the motor. The temptation to replace a fuse with a strip of metal or a handy nail is well known to anyone experienced in industrial power work.

Planing mills are rather noisy when in operation, and a signal system has been designed to ensure that the machines receive attention when required. When an operator wishes to call a machinist to make an alteration or repairs, he steps to the nearest post and switches on a red light, showing on the glass the number of his machine. He then pulls the cord of a whistle operated by compressed air and the machinist has only to look up to discover where he is wanted.

The lighting throughout is by metallic filament of from 60 to 250 watt capacity, and the control is from the filing room above the planing mill floor.

Individual lights and pilot lights are supplied from a separate distribution board, while the general lighting is controlled by six triple pole 50 amp. switches controlling lighting panels distributed through the mill.

The lighting system is entirely separate from the power, so that an accident to the power feeders would not leave the mill in darkness. This also permits of better voltage regulation.


Rear View of Distributing Panel.

At all points electricity has proven its efficiency in planing mill work and in particular in the manner it is possible to keep the speed of production at the desired level, the lagging speed of an over-loaded engine is easier to observe than rectify. It is clean and changes and extensions are easy to make.


Everett G. Griggs.

President E. G. Griggs of the St. Paul & Tacoma Lumber Company has long been an advocate of electric drive, and the electrical profession has reason to appreciate the efforts of such progressives, without whose co-operation electricity in the lumber industry would not hold the place it does, and the future it has in store.

ELECTRICAL PUMPING AND IRRIGATION

CONSTRUCTION OF CONCRETE PIPE LINES.

BY B. A. ETCHEVERRY.

Excavation of the trench should be sufficiently deep to have an earth covering of at least 12 in. and preferably 18 in., or even more. The bottom of the trench should be evenly graded to avoid short siphons which may produce air chambers in the pipe. The width of the trench should be larger than the outside diameter of the pipe by about 12 in. to allow the pipe layers sufficient space in which to work. The trench width and depth with the cost of excavation are given in the table below, based on an 18 in. depth of earth covering. The cost of excavation and backfilling is assumed at 20 cents a cubic yard.

Cost of Excavation for Cement Pipe Lines in Cents Per Lineal Foot.

Size of pipe. Inches.	Depth of trench. Inches.	Width of trench Inches.	Excavation in cu. yds. per lineal foot.	Cost of excavation in cents
6	26	20	.13	2.6
8	28	22	.16	3.2
10	31	25	.20	4.0
12	33	27	.23	4.6
14	35	29	.27	5.4
16	38	32	.32	6.4
18	40	34	.35	7.0
20	42	36	.38	7.6
24	47	41	.50	10.0
26	49	43	.55	11.0
30	54	48	.66	13.2
36	60	54	.83	16.6

In laying the pipe it is placed in the trench standing on end with the bell or groove end up. To lower the large pipes more easily they may be slid on a chute or skid made of timber. The pipe sections are joined with a mixture of 1 part of cement to 2 of fine sand. The taper end of the pipe which has already been laid, and the bell end of the pipe to which it is to be joined, are brushed clean and well wetted with a fiber brush. About an inch of the soil under the bottom of the joint to be made is removed and a trowel full of mortar is spread in its place to form a bed of mortar. The bell end of the pipe which is standing on end is filled with cement mortar and is jammed against the taper end of the previously laid pipe. The mortar which is squeezed out on the inside of the joint is wiped with a wet brush to form a smooth joint. To complete the joint a band of mortar from 2 to 3 in. wide and ¼ to ½ in. thick is formed on the outside of the pipe.

Laying Hand Tamped Cement Pipe.

It is always preferable to lay the pipe uphill to avoid the shrinkage at the joints due to the pipe pulling away. It is well to protect the bands from the action of the sun for about 30 minutes before backfilling by using wet burlap or by placing a board over them. To raise a pipe and hold it on grade do not use clods but shovel in dirt and compact it by tamping. The bands should be wetted before backfilling. Backfilling must be done carefully by shoveling the earth free from rocks, around the pipe and tamping it until the pipe is well covered. This, however, is not so essential with loose sandy soil which naturally packs very easily. The pipe should not be used for at least 2 to 3 days, especially if under pressure, to give sufficient time for the bands to harden.

In the accompanying table is given information regarding the laying and hauling of cement pipe, based on the wagon and cost of material given above. Two per cent has been allowed for supervision, organization, breaking of pipe and miscellaneous.

Cost of Laying and Hauling Cement Pipe, in Cents per Lineal Foot.

Diameter in inches.	Weight of pipe in pounds per foot.	Number of feet laid per barrel of cement.	Number of men in laying crew.	Number of feet laid per day.	Cost of laying, exclusive of trenching and hauling, in cents per foot.	Cost per foot of hauling two miles.
6	20	500	3	600	2.25	.9
8	32	400	3	600	2.50	1.4
10	42	350	3	500	3.00	1.9
12	56	300	3	450	3.50	2.5
14	69	225	3	400	4.00	3.1
16	85	200	3	300	5.00	3.8
18	100	175	4	300	6.25	4.5
20	110	150	4	300	6.60	5.0
24	160	100	6	300	10.00	7.2
26	175	85	6	250	12.0	7.9
30	220	75	6	200	14.0	9.9
36	320	60	7	200	17.0	14.4

The cost data given in the preceding tables are assembled and given below.

Cost of Making, Laying, Trenching and Hauling Cement Pipe in Cents per Lineal Foot.

Diameter of pipe in inches.	Cost of making. 1:3 pipe.	1:4 pipe.	Cost of laying.	Cost of trenching.	Cost of hauling two miles.	Total cost. 1:3 pipe.	1:4 pipe.
6	10	7	2.25	2.6	.9	15.75	12.75
8	12	9	2.50	3.2	1.4	19.10	16.10
10	15	11	3.00	4.0	1.9	23.90	19.90
12	20	15	3.50	4.6	2.5	30.60	25.60
14	25	20	4.00	5.4	3.1	37.50	32.50
16	30	25	5.00	6.4	3.8	45.20	40.20
18	35	30	6.25	7.0	4.5	52.75	47.75
20	43	35	6.60	7.6	5.0	62.20	54.20
24	60	50	10.0	10.0	7.2	87.20	77.20
26	75	63	12.0	11.0	7.9	105.90	93.90
30	85	70	14.0	13.2	9.9	122.10	107.10
36	115	95	17.0	16.6	14.4	163.0	143.00

These cost values agree quite closely with those given below which are those obtained for about 5 miles of pipe on the irrigation system of the Fruitlands Irrigation & Power Company near Kamloops. The concrete mixture used was composed of 1 part of cement to 2½ of sand and 1½ of stone, which corresponds to a 1 to 3 mixture of cement and pit gravel. Cement cost $3 a barrel, sand 75 cents a cu. yd, crushed

rock $2.50 a cu. yd., common labor $2.50 per day, skilled labor $3 to $3.50 per day, and teams $5 per day. The cost given includes all materials, labor, supervision, and depreciation on plant.

Cost of Making and Laying Concrete Pipe on Irrigation System of Fruitlands Irrigation & Power Co., Near Kamloops.

Diameter of pipe. Inches.	Cost of making. Cents.	Cost of laying. Cents.	Total cost. Cents.
8	11.1	....	....
10	15.7	....	....
12	20.	11.	31.
16	29.5	15.5	45.
20	39.5	20.3	59.8
24	54.7	23.3	78.

Other Methods of Making Cement Pipe.

The lack of uniformity in the pipe made with a dry mixture tamped by hand as described above and the porosity of the pipe, have led to other processes of making pipe, some of which are still in the experimental stage. Two methods have been used, machine tamping and the wet process.

Machine tamped pipe is made by a number of plants in the West, including one at Peachland. The pipe is made with a comparatively dry mixture much in the same manner as hand made pipe, but the mixture is thoroughly tamped by a mechanical tamper of small cross section which tamps rapidly and gives a high degree of compression. The inside core also rotates during the tamping processes and this gives the inside of the pipe a very smooth surface. The pipe obtained by this process is very dense. It should be uniform and superior to the handmade pipe, especially when a pipe is desired for pressure heads greater than the handmade pipes will stand. The pipe is made with a bell similar to sewer pipe. This requires more material than the shiplap end obtained with the handmade pipe, which increases the cost.

To make pipe by the wet process, a wet mixture of cement mortar or cement concrete is poured in the mould and after the mixture has hardened, the moulds are removed. As this takes several hours, only a few pipes can be made per day. For a large output several moulds would be needed and the cost of the plant would be high. However, the moulds need not be as strong as those used for hand tamping and could be obtained at a much smaller cost. The increased cost of plant would be overbalanced if a large quantity of pipe was made by the saving in labor and also by the saving in cost of material because a pipe equal in strength and impermeability could be obtained with less cement. To reduce the number of moulds it has been attempted to accelerate the hardening of the mixture by heating it with steam. This process, however, is still in an experimental stage. The U. S. Department of Agriculture, through its Irrigation Investigations Office, is investigating the wet method of making pipe. The U. S. Reclamation Service has also devised methods of making a wet mixture cement pipe at a reasonable cost for the Tieton irrigation project in Eastern Washington, and for other projects. Their results have not yet been published.

Ebonite of the best quality should withstand a voltage gradient of 125,000 volts per mm.

OREGON REGULATIONS ON LINE CONSTRUCTION.

The Railroad Commission of Oregon has prepared tentative general regulations governing overhead and underground construction of telegraph, telephone, signal, trolley and power lines throughout the State. These regulations apply to new construction in Oregon and are not to be construed as limiting the right of the commission to change any installation that is believed to be hazardous. It is not intended, by these general regulations, to supersede any local municipal regulations or ordinances.

Overhead Clearance.

1. Railroads and Street Railroads:

a. When telegraph, telephone or signal lines, or power lines of not exceeding 600 volts, cross above railroads or street railroads, a minimum clearance of 25 ft. shall be provided, except that the clearance above trolley wires and trolley feeders hereinafter specified (Section 1-c) shall in all cases be observed.

b. When power lines, other than trolley wires and trolley feeders, which transmit power at from 600 to 15,000 volts, cross above railroads or street railroads, the minimum clearance shall be 28 ft. When such lines transmit power in excess of 15,000 volts the minimum clearance shall be 34 ft.

c. When trolley wires or trolley feeders cross above railroads or street railroads, a minimum overhead clearance shall be provided of 23 ft., or otherwise as specified in Section 5 of this order.

2. Streets and Public Highways:

Telegraph, telephone and signal lines, and power lines of not exceeding 600 volts, which cross above streets or public highways, shall have a minimum overhead clearance above the surface thereof of 20 ft.; power lines of from 600 to 15,000 volts, 24 ft.; power lines of above 15,000 volts, 30 ft.; and trolley wires and trolley feeders, 19 ft. The minimum clearance for such lines, above railroads and street railroads which occupy streets and public highways, hereinbefore specified in Section I, shall in all cases be observed.

3. Telegraph, Telephone and Signal Lines:

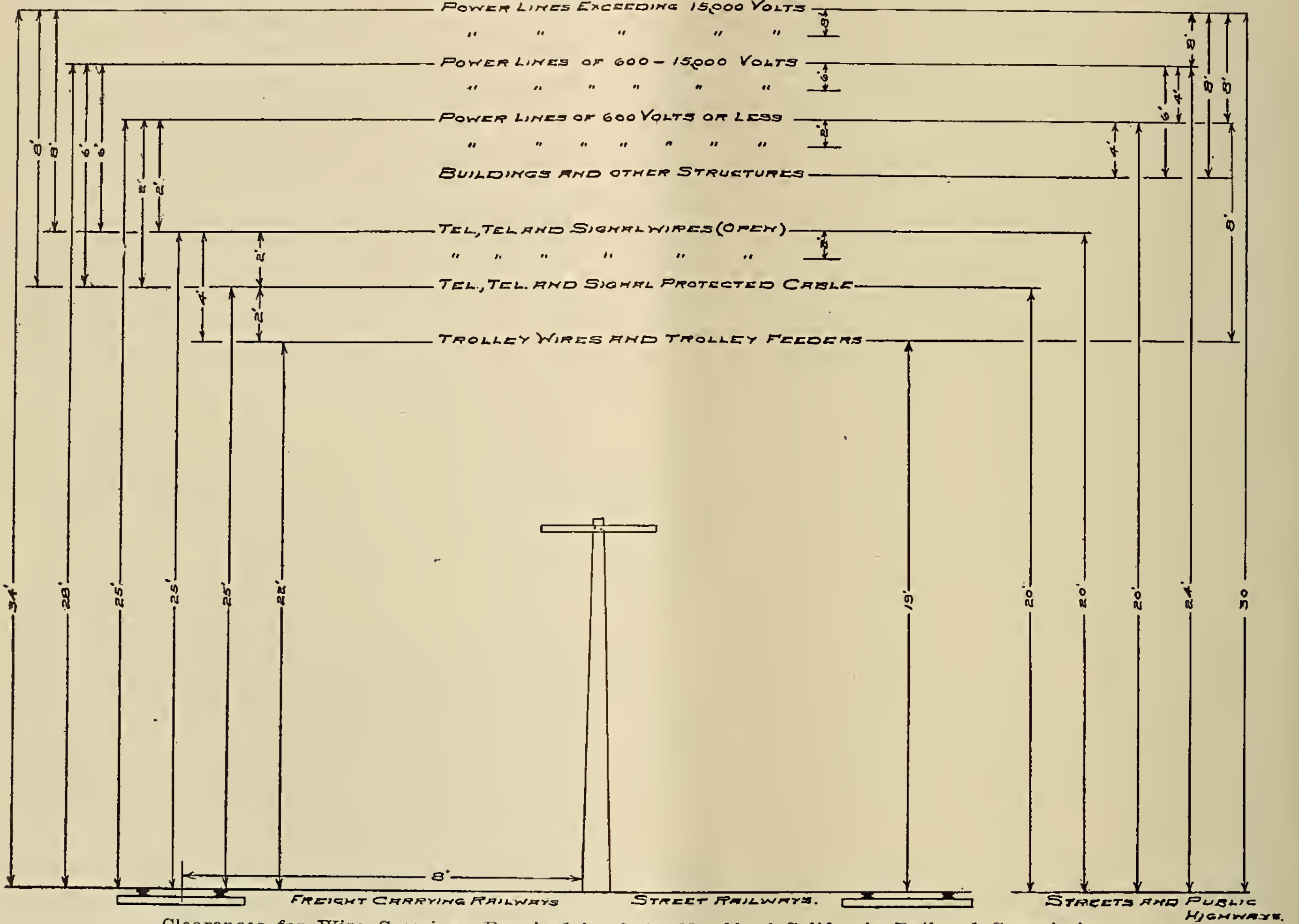
Telegraph, telephone and signal lines, at crossings with telegraph, telephone or signal lines of other companies, shall have a minimum clearance, above or below such lines, of 2 ft., unless suitably supported to prevent contact; above trolley wires or trolley feeders, 4 ft., except for properly protected cables, when 2 ft. will be permitted; below power lines of 600 volts or less, 2 ft.; below power lines of from 600 to 5000 volts, 4 ft.; below power lines from 5000 to 15,000 volts, 6 ft., and below power lines of exceeding 15,000 volts, 8 ft.

4. Power Lines—Other than Trolley Wires and Trolley Feeders:

a. Power lines, other than trolley wires and trolley feeders, of not exceeding 600 volts, shall have a minimum clearance above rails at crossings with railroads and street railroads of 25 ft.; above streets and public highways, 20 ft.; above telegraph, telephone and signal lines; 2 ft.; above or below other power

lines or not exceeding 600 volts, unless suitably supported to prevent contact, 2 ft.; above all trolley wires and trolley feeders, 4 ft.; above or below other power lines of from 600 to 5000 volts, 4 ft.; below other power lines of from 5000 to 15,000 volts, 4 ft.; below other power lines of exceeding 15,000 volts, 8 ft.; and above all buildings and structures, 4 ft.

b. Power lines, other than trolley wires and feeders of from 600 to 15,000 volts, shall have a minimum clearance above rails at crossings with railroads and street railroads, of 28 ft.; above streets and public highways, 24 ft.; above telegraph, telephone and signal port standard freight cars; shall have a minimum clearance above their own rails of 23 ft., and of other street railroads, 19 ft., provided, that when street railroads which do not transport or propose to transport standard freight cars are on streets or public highways which cross under other railroads, such minimum clearance of the trolley wire above rails shall be 13 ft. and 6 in. Such trolley wires and trolley feeders shall have a minimum clearance at crossings above the rails of other railroads and street railroads which transport or propose to transport standard freight cars, of 23 ft.; and above other street railroads, 19 ft.



Clearances for Wire Crossings Required by Order No. 26 of California Railroad Commission.

lines, for power lines of from 5000 down to 600 volts, 4 ft., and for power lines of from 5000 to 15,000 volts, 6 ft.; above or below other power lines of not exceeding 600 volts, 4 ft.; above or below other power lines of from 600 to 15,000 volts, 6 ft.; below other power lines of exceeding 15,000 volts, 8 ft.; and above all buildings and structures, 6 ft.

c. Power lines of exceeding 15,000 volts shall have a minimum clearance above rails at crossings with railroads and street railroads of 34 ft.; above streets and public highways, 30 ft.; above telegraph, telephone and signal lines, 8 ft.; above other power lines of not exceeding 15,000 volts, 8 ft.; above or below other power lines of exceeding 15,000 volts, 8 ft.; and above all buildings and structures, 8 ft.

5. Trolley Wires and Trolley Feeders:

Trolley wires and trolley feeders or railroads, and street railroads which transport or propose to transport standard freight cars; shall have a minimum ... Trolley wires and trolley feeders shall have minimum clearance below telegraph, telephone, signal and power lines as hereinbefore provided.

6. All power lines transmitting power at 15,000 volts and in excess thereof, and which cross over railroads, street railroads, telegraph, telephone, signal and other power lines, shall be constructed to conform to the "Specifications for Overhead Crossings of Electric Light & Power Lines" adopted at the present time by the joint committee of the National Electric Light Association, the Association of Railway Telegraph Superintendents, and the American Railway Engineering and Maintenance of Way Association, in so far as the same are not in conflict with any of the provisions of the law of the State of Oregon, and except further that the clearance hereinbefore provided in this order, together with the restrictions thereon, shall be observed.

NOTE 1. It will be understood that this Commission adopts the specifications at present issued by the Joint Committee above named and any change, modification or alteration in same which may hereafter be issued or adopted by said Joint Committee will not be applicable to the matters contained in this order until submitted to and approved in formal order by this Commission.

NOTE 2. As an alternative for the construction prescribed in the above specifications, pole of such length may be used for the crossing spans that a wire breaking at any point in the crossing span will swing clear of the wire leads below. As a further alternative, conditions permitting, when such power lines cross telegraph or telephone lines, the latter may be placed underground at the crossing span.

NOTE 3. As an alternative, conditions permitting, telegraph and telephone lines and power lines of less than 600 volts may be placed underground wherever they cross railroads or street railroads.

NOTE 4. The minimum clearance for wire lines hereinbefore provided shall have reference to clearances which will obtain under the most unfavorable conditions of temperature and loading in the district concerned, provided that the prescribed factors of safety are observed.

Construction.

7a. The minimum size of wire to be used where power lines cross above railroads or street railroads, telephone, telegraph or power lines shall be as specified or their equivalent in strength.

For power lines other than trolley wires and feeders of less than 600 volts—No. 10 B. & S. G. Copper.

For power lines of more than 600 volts and less than 5000 volts—No. 6 B. & S. G. Copper.

For power lines of over 500 volts, series or constant current circuits excepted—No. 4 B. & S. G. Copper.

7b. At crossings as specified under 7a where wooden poles are used, the maximum length of span for wires carrying voltages above 600 shall be 150 ft., and only the best selected poles of a minimum diameter of 7 in. shall be used.

8a. When more than one cross arm is mounted on a pole, no cross arm supporting a wire or cable carrying a voltage in excess of 600 shall be placed within a distance less than 4 ft., measured center to center, from any other cross arm supporting a wire or cable carrying a voltage of less than 600.

8b. No wire or cable carrying a voltage in excess of 600 shall be placed within a distance less than 14 in., measured from center to center of insulator, from any other wire or cable on the same cross arm, provided that this minimum spacing shall not apply to wires of the same potential.

8c. No wire or cable shall be placed on any pole support within a distance of 15 in. from the center line of said pole, provided that telephone, telegraph and signal wires may be placed within a distance of 15 in.; and provided that this rule will not apply to wires or cables run vertically from underground, or to wires run from circuit wires to lamps or transformers supported on the same pole, or to telephone cables supported by messenger cables.

9. No guy wire or guy cable attached to any pole or appliance to which is attached any wire or cable used to conduct or carry electricity shall be placed without causing said guy wire or guy cable to be effectively insulated at all times at a distance of not less than 4 ft. nor more than 8 ft. (measured along the line of said wire or cable) from the upper end thereof and at a point not less than 8 ft. vertically above the ground from the lower end thereof; provided that no insulation shall be required at the lower end of a guy wire or cable where the same is attached to a grounded anchor. This regulation shall not apply to guy wires or cables attached to poles carrying telegraph, telephone or signal wires and cables, or to power wires or cables carrying a voltage of less than 600, and which are situated outside the corporate limits of any town or city.

10. Fixtures placed or erected for the support of wires on the roofs of buildings shall be of sufficient strength to withstand all strains to which they may be subjected, due to the breaking of all wires on one side thereof, and, except where insulated wires or cables are held close to fire walls by straps or rings, shall be at such a height as to give the clearances herein specified for structures, and any wire or cable carrying a voltage in excess of 600 shall be marked with the word "Danger" in letters at least 3 in. high on the supporting structure and at all other points where there is a hazard.

11. In all cases where wires which are conductors of electricity are strung above or below lines which are used to carry electricity in excess of 600 volts, suitable appliances shall be furnished the workmen to guard against accidents, e. g., drag ropes, insulated clamps, insulated loops and other appliances which will prevent contact with the wires carrying electricity in excess of 600 volts in any manner or event.

12. When lines of 600 volts or over are cut out at station or substation to allow employes to work upon them, they shall be short-circuited and grounded at the station, and shall, in addition, if the line wires be bare, be short-circuited, and when possible grounded at the place where the work is being done.

Location.

13a. Telephone and telegraph lines, and telephone and power "drops" or "service wires" must be placed below power wires carrying 600 volts or over at the clearances hereinbefore specified. Where it may be shown to be impracticable to string telephone and telegraph wires below power wires which are used to carry in excess of 600 volts, the telephone or telegraph line must employ the same mechanical strength of construction as would be required in case said power lines were constructed over the telegraph, telephone and signal lines.

13b. Power lines of more than 600 volts shall be constructed along one side of any public highway and telegraph, telephone and signal lines shall be constructed on the opposite side of said public highway unless it is shown to be impracticable.

13c. No company shall construct a pole line which will parallel "overbuild" or "underbuild" any existing pole line without first giving such other company reasonable notice in writing of its intention to do so, provided that this provision shall not apply to wires crossing over or under existing wires at an angle.

General.

14. The neutral point or wire of all transformer secondaries strung or erected for use in low potential distributing system shall be grounded in all cases

where the normal maximum difference of potential between the ground and any point in the secondary circuit will not exceed one hundred and fifty (150) volts. When no neutral point or wire is accessible, one side of the secondary circuit shall be grounded in the case of single-phase transformers, and any one common point in case of interconnected polyphase bank or banks of transformers. Where the maximum difference of potential between the ground and any point in the secondary circuit will, when grounded, exceed one hundred fifty (150) volts, grounding shall be permitted. Such grounding shall be made by connecting a wire or wires not less than No. 6 B. & S. gauge to: (a) A water pipe of a metalic system; (b) A copper plate 1/16 in. thick and not less than 3 ft. by 6 ft. area buried in coke below the permanent moisture level; (c) Other device equally as efficient.

15. Transformers, either single or in bank, that exceed a total capacity of ten kw. shall be supported by a double cross-arm or some fixture equally as strong. No transformer shall be placed on any cross-arm or other appliance on a pole upon which is placed a series electric lamp.

16. Any change in the characteristics of a line which carries or is to carry voltage in excess of 5000 shall be reported to the commission.

17. As between any two wires or cables carrying different voltages mentioned in these rules, only the wires or cables so placed last in point of time shall be held in violation thereof.

Underground.

18. No manhole containing any wire carrying a current of over 300 volts shall be less than 6 ft. from floor to inside of roof; if circular in shape it shall be 6 ft. from wall to wall; provided however, that this paragraph shall not apply to any manhole in which it shall not be required that any person enter to perform work; provided further, that the foregoing provisions of this paragraph shall not apply where satisfactory proof shall be submitted to the proper authorities that it is impracticable or physically impossible to comply with the law within the space or location designated by the proper authorities.

19. All manholes containing any wires or appliances carrying electrical current shall be kept in a sanitary condition, free from stagnant water or seepage or other drainage which is offensive or dangerous to health, either by sewer connection or otherwise, while any person is working in the same.

20. No manhole shall have an opening to the outer air of less than 26 in. in diameter, and the cover of same shall be provided with vent hole or holes equivalent to three square inches in area.

21. No manhole shall have an opening which is, at the surface of the ground, within a distance of 3 ft. at any point from any railway or street car track; provided, that this shall not apply where satisfactory proof shall be submitted to the proper authorities that it is impracticable or physically impossible to comply with the provisions of this paragraph; provided, that in complying with the provisions of this rule only the construction last in point of time performed, placed or erected shall be held to be in violation thereof.

22. Whenever persons are working in any manhole whose opening to the outer air is less than three feet from the rail of any railway or street car track, a watchman or attendant shall be stationed on the surface at the entrance of such manhole at all times while work is being performed therein.

23. There shall be provided cutout switches on all primary and secondary wires in all manholes where the wires are connected with transformers or other electrical devices therein.

24. All persons employed in manholes shall be furnished with insulated platform so as to protect the workmen while at work in the manhole; provided, that this paragraph shall not apply to manholes containing only telephone, telegraph or signal wires or cables.

MULHOLLAND'S REPORT ON LOS ANGELES AQUEDUCT.

The annual report of William Mulholland, chief engineer of the water department at Los Angeles, is largely concerned with the disposition which is to be made of the water from the Los Angeles aqueduct. A line 25.58 miles in length is being constructed from the aqueduct outlet to Los Angeles to serve the city as well as the territory through which it passes, together with the land south of the Santa Monica Range and the mouth of Franklin Canyon, these lands being supplied from surplus water to be stored in the San Fernando reservoir.

The construction of the lower San Fernando dam has progressed at a very satisfactory rate since the work of placing the earth in the main body was begun in the summer of 1912. The earth is being placed by the pumping and sluicing method and is progressing at the present time at the rate of approximately 4000 cubic yards per day, there being approximately 800,000 cubic yards already in the structure. The work of building the gate tower will be begun about September 1, and will probably be completed by the first of the year.

At the south end or exit of tunnel No. 108, which is the point of termination of the aqueduct proper and the point of beginning of the Franklin Canyon line, a substantial and permanent structure has been completed to discharge the aqueduct flow. From this portal a concrete conduit is carried down the summit of a projecting ridge of the mountain range by a steep descent having a fall of 167 ft. in a distance of 1036 ft. and so constructed as to give as near as possible a natural cascade effect to the descending water. While the purpose of this design is mainly esthetic, it has a utilitarian value in thoroughly aerating the water as it flows from the aqueduct.

Natural Cascade.

From the foot of the cascade a concrete conduit passes down approximately through the center of the Upper San Fernando reservoir site and enters a covered conduit at a point below the site of the dam for this upper reservoir. Here it is intended at some future time to construct a power plant. From this point a covered conduit follows the meander of the high-water line on the west side of the lower San Fer-

nando reservoir at the west end of the dam, where it enters a gate tower from which leads the closed or pressure portion of the Franklin Canyon line.

This tower is designed so that it may not alone deliver the water from the by-pass, but also by means of gates with which it is furnished, draw upon the reservoir in case of interruption in the aqueduct flow. The cascade, the open and the covered conduit including two short tunnels, from the outlet of the aqueduct to the tower, a distance of 16,334 ft., have been completed and preparation for the construction of the tower is under way.

Below the gate tower the line consists of steel pipe for a distance of 65,030 ft. to the northerly end of the Franklin Canyon tunnel.

At the lower point of the San Fernando Valley where this pipe crosses the Los Angeles River the pressure will be 115 pounds to the square inch and blow-off gates will be placed here so that, in case of necessity, water can be discharged into and carried in the natural channel of the river to the present headworks plant at the inlet of the main supply conduit. The contingency for this, however, is somewhat remote as the added growth of the city to the southwest will be met by the line at its southerly terminus, thus relieving the draft on the old headworks.

From the dam of the Lower Franklin Reservoir into Los Angeles, the line will consist of a steel pipe sixty inches in diameter down to Sunset boulevard, a distance of 4608 ft., to radiate in lines of smaller diameters, two of which will connect with the mains of the city's present distribution system. One line, thirty-six inches in diameter, will terminate in the thirty-inch cast-iron main along Western avenue at Pico street, and another twenty-four inches in diameter will extend along Santa Monica boulevard through Hollywood. Designs for other branches are not yet worked out.

REDUCTION OF ELECTRIC RATES IN TUCSON, ARIZ.

Effective August 1, 1913, rates for electricity will be greatly reduced through an opinion handed down July 10th by the corporation commission, in the case of Mayor I. E. Huffan against the Tucson Gas Electric Light & Power Company, in which it was urged that the rates were discriminatory. The commission declared that the gas department of the company's business is not earning an amount in excess of a fair rate of return. The commission approved the $5.00 deposit for residence service and $10.00 deposit for store service, for the reason that if these deposits were not required and the company should suffer loss for service unpaid for such loss would directly react upon the customers.

The lighting rate established provides for a maximum charge of 11c per kw.-hr. for the 1st 100 kw.-hr. consumed in any month, with sliding reduction for larger consumption, and a minimum charge of $1.00 per month. The power rate is 10c per kw.-hr. for the first 100 kw.hr. consumed in any one month, with sliding reduction for larger consumption, and a minimum charge of $1.50 for 2 h.p. or less.

THE SOCIETY FOR ELECTRICAL DEVELOPMENT.

BY J. ROBERT CROUSE.

There are always some underlying, basic principles governing all change and progress—whether in the field of research, engineering, manufacturing or merchandising. These principles are of the same essential quality as the axioms in mathematics or refined statements of particular relations, such as $C = E/R$ in our electrical business. Such principles do not depend for their truth or power upon minority or majority assent, and when once fairly stated, are assured of final acceptance since essential progress must be made in harmony with them.

Progress in our electrical business during thirty years (notwithstanding that less than 30 per cent of the population is electrically served) has been one of the wonders of the world; its contribution to the comfort, happiness and efficiency of our modern life are so great that we wonder how a preceding generation did without it. We may justly feel proud of such a magnificent business which in every department of its development is so worthy of our best thought and effort.

The efforts of those engaged in the fields of research, engineering and manufacturing have shown the most marked results, since, while enjoying the stimulus of the friendly rivalry of other men and organizations, they have been free from the sort of competition which makes the accomplishment of useful results expensive and difficult. It is a matter of common observation that rapid progress has been made in discovery and research, in efficient engineering adaptation of discovery to practical manufacture, and improved products tending to better conditions of generation, construction and distributing systems.

However, in the field of selling and distribution we are challenged by the cold fact that no essential progress—meaning by this a decreasing ratio of sales expense to sales—has been generally accomplished. Not only this, but there is a prevailing opinion among the manufactures, jobbers, dealers and contractors that the ratio of sales expense to sales tends to increase. The annual report of some of the largest electrical manufacturers makes specific mention of this tendency as a fact in their operation. Among central stations this is doubtless true, since by common consent they are properly monopolistic for the best results and competitive only with other methods of furnishing service for light, heat, power and other useful purposes.

Our electrical business, technical in its very nature, has doubtless for that reason placed less emphasis in the past on aggressive selling and distributing effort—witness the fact that the first commercial papers in the National Electric Light Association appeared only so recently as 1905, and national advertising by individual companies began about 1907-1908.

It is estimated that the gross sales, ratio of sales expense and sales expense for 1912, in the electrical business, were approximately as indicated in the following table.

Branch of Business.	Gross Sales, 1912.	Per Cent Ratio Sales Expense to Sales.	Sales Expense 1912.
Central Stations	$400,000,000	5%	$20,000,000
Manufacturers and Jobbers	300,000,000	15%	45,000,000
Dealers and Contractors...	100,000,000	15%	15,000,000
Total	$800,000,000		$80,000,000

This $80,000,000 of sales effort (which is equal to one-fifth of the gross sales of all the central stations) is incurred by approximately 5,000 central stations, 500 manufacturers, 200 jobbers, 5,000 dealers and contractors—a total of 10,700 organizations. It is of special importance to note that $60,000,000 of this $80,000,000 sales effort is incurred by the manufacturers, jobbers, dealers and contractors who operate under the complete competitive conditions, as a sales expense ratio of at least 15 per cent—and tending to increase.

While this table and the above comments are broad generalizations, the reader is asked to check the principle and its application in his own particular case.

These facts in themselves are a challenge to commercial men, which cannot be avoided. They justify the most careful search for causes and investigation of plans for improvement.

Whatever minor causes may be contributory to this failure in more efficient merchandising, the major one, which experience and the facts disclose, is competition among these thousands of companies, resulting in expensive duplication of all kinds of sales efforts and failure to co-operate in a definite organized plan in those kinds of endeavor which supplement legitimate competition.

This competition is to a very great extent to secure the business held by others or of natural growth—which we may characterize as the existing market. A very large part of the selling effort is exerted on this existing market and dissipated in commercial friction and lost motion, with resulting decrease in its creative effect.

The fact is frequently overlooked that the current consuming devices for light, heat and power and other useful purposes are the only aspects of our business in which the public are or can be interested, while they constitute but a small part of the resulting business from the boilers to the devices the public uses. We are therefore all, without conscious organization, joint sellers of the final service.

The age of business (in which someone has said we live to do business, instead of doing business to live, in the base sense) is in the order of social development the successor to the period when war—the extreme of competition—was the principal occupation. Business has inherited from his prototype many habits of enmity, antagonism and waste, which only the persistent cultivation of good fellowship, harmony and economy will gradually supplant. The most successful organizations which I have observed have given the greatest attention to the cultivation of harmony among their men, and the spirit of progressive, constructive effort. This same result must measurably follow similar conscious effort by an entire industry.

The Society of Electrical Development proposes a broad, common organization of our entire industry: central stations, manufacturers, jobbers, dealers and contractors (controlled by a balanced representation from each), through which a part of this $80,000,000 of unorganized and competitive sales effort can be more effectively exerted through organized and co-operative effort in promoting and popularizing electrical service. These plans to teach the public to "Do it electrically"—many more than can at once be undertaken—have been worked out and endorsed as entirely practical by many prominent men in our business.

The Society proposes at the start that a minimum of $200,000 or but one-fourth of one per cent of this $80,000,000 of competitive sales expense, be co-operatively expended. The basis of subscription is for manufacturers, and central stations, one-fifteenth of one per cent of gross sales, and one-twentieth of one per cent for jobbers, dealers and contractors, amounting, for illustration, in the case of the former, to $66.66 per $100,000 of gross business, and in the latter to $50 per $100,000 of gross business—the subscription being on an annual basis. This means in the case of a company having a 15 per cent sales expense account, but one-three-hundredth of their sales appropriations. There are few organizations which cannot locate competitive expenses of doubtful value equal to the Society's subscription. While individual subscriptions are comparatively small and in no sense burdensome, yet general co-operation in the movement will make a fund of $500,000 per annum available for progressive and aggressive market cultivation along these new lines.

This Society creates the organization and the fund through which some of our dollars can co-operate with the good will of us all in broad effective activity for the expansion of the market, while we continue with the most of our dollars to compete for our fair share.

This plan means progress in the direction of more efficient distribution of electrical service through joint cultivation of our common market—the great preoccupied, incredulous, money-spending public—a result which our present systems neither accomplish nor promise ever to achieve on the old lines.

The plan presents a new kind of consolidation for sales efficiency through a better balance of competitive and co-operative effort to which the popular thought will not now nor in the future take exception.

The plan means that electrical men—identified with this most wonderful of all business—will demonstrate for themselves and by example for others—the true principles which underlie progress in more efficient sales distribution, through the creative cultivation of the market. The plan lends dignity to the art of selling—synonymous in the best sense with service—and marks a further point in the age now happily passing, when the selling spirit was symbolized in the economist's expression "Caveat Emptor"—"Let the buyer beware."

The emergency telephone outfit of forest rangers, used chiefly in fighting fires, consists of small instruments and a coil of fine copper wire. The wire is attached to the nearest telephone line, an army bayonet is thrust into moist ground at the other end, and with the circuit thus completed the ranger can talk with headquarters, report his position, and summon fire fighters if necessary.

SMOKE AND COMBUSTION.

BY M. CECIL DAVIS.

(The following remarks on a problem of vital interest to engineers are taken from a paper presented by the author before the Smoke Problem Committee of the Commonwealth Club of California.—Ed.)

There are various oils burners used throughout the steam plants, almost every engineer using a different kind. Some of the large plants have adopted a burner which has been proven from scientific experiments and conditions to be not only economical in fuel, but also a smoke preventative. The primary cause of smoke is incomplete combustion, caused by defective and badly regulated burners, and the inefficiency of the fireman.

The burning of fuel is accomplished by bringing the oxygen of the air into intimate contact with the combustible elements under proper conditions of temperature. In the calorimeter we get the total heat from fuel by using oxygen under pressure so that perfect mixture ensues, giving the desired chemical combination. In the furnace, good combustion is accomplished in the following manner: The volatile matter driven off from the fuel combine with air in the ratio of one part of carbon to two of oxygen to form carbon dioxide CO_2. The volatile matter or hydro-carbons must first pass into a gaseous state and mix thoroughly with hot air, forming CO_2 and hydrogen which combines with oxygen and forms water in the condition of steam, due to the high temperature. Theoretically, this is complete combustion.

Incomplete combustion takes place first by insufficient or incomplete mixture of air, allowing the CO_2 from the fuel to combine with more carbon to form CO. The hydro-carbons mixed with cold air pass off unconsumed, or if raised to a red heat and without sufficient air disengage the carbon in fine powder and pass to the condition of moist gas and hydrogen. The higher the temperature under the conditions of sufficient air, the greater the proportion of carbon powder, and when the carbon powder is below the temperature of ignition, before coming in contact with oxygen, it passes off as smoke. For a complete combustion it is necessary to have not only sufficient air, but it must be intimately mixed at the right place, which is the oil burner or the fire box. Too much air is a detriment because it absorbs the heat and acts to some extent as an insulator between the hot gases and the heating surface. Smoke is unnecessary and positively wasteful. It is a constant and visible proof of imperfect combustion of fuel, and therefore evidence of a waste of part of the fuel. This waste, however, is not nearly so important to the owner of the establishment as the losses of heat and power that are its inevitable concomitants, the points to which I wish to direct your attention of, are:

First that a smokeless stack does not always denote high furnace efficiency, but when it does not, the fault always lies with the engineer. Second, that the making of smoke means direct waste of money to the manufacturer. Third, that a steam jet of any kind should not be used as an abater. Fourth, to improve a steam plant, we should begin at the boiler and not at the engine. Fifth, that sufficient area and proper arrangement of the combustion chamber are among the principal factors in smoke abatement. Sixth, that the smoke makers have their own protective devices so as to arrange their plants as to render them practically smokeless, that steam tube blowers be prohibited, also steam jets which are used in the stacks or uptakes.

REPORT ON TWIN PEAKS TUNNEL FOR SAN FRANCISCO.

The San Francisco Board of Public Works' report on the Twin Peaks tunnel comprises a description of the project and an estimate of the cost. The general description calls for a tunnel through the Twin Peaks ridge, the northeasterly portal of which is to be situated near the easterly line of Collingwood street 64 ft. southerly from Seventeenth street. The southwesterly portal is to be situated in the Rancho San Miguel at a point near the intersection of the projected center lines of Twelfth avenue and Taraval street. Two additional entrances to the tunnel are to be located where the tunnel will run under Eureka street and where it will run under the southerly boundary line of the Relief Home Tract.

Generally the main bore of tunnel is to be constructed to be approximately twenty-four feet wide in the clear and to be properly bored and properly and suitably lined with masonry where necessary, said masonry to be re-enforced where necessary, and with suitable and convenient excavations for and construction of stations at said tunnel entrances above mentioned, properly lined and faced with suitable material, with convenient and suitable platforms and passageways and conveniences; the sides of said approaches by means of open cuts to be properly supported with proper and suitable retaining walls or bulkheads with proper coping and balustrades or railings constructed of masonry to be re-enforced where necessary, and said portals or entrances to be properly constructed of masonry; said tunnel to be furnished with proper shafts for ventilation at necessary points and with suitable provision for drainage and to be provided with all appurtenances necessary to make said tunnel fit and convenient for public use.

Two districts have been selected as being benefited by the proposed improvement and are to be assessed to pay the cost thereof.

The report contains a statement of the estimated cost of the improvements as follows:

Cost of construction	$3,347,823.23
Incidental expenses	125,000.00
Lands taken in fee	511,098.00
Easements acquired	6,528.00
Leaseholds taken	3,840.00
Total	$3,994,289.23

An area comprising nearly one-sixth of the total area of the city, now practically inaccessible, will be brought into quick and easy communication with the business center by means of the tunnel.

The estimated time given the contractor to complete the work is 600 calendar days and a bonus will be given or a penalty exacted of $750 a day as an inducement to the contractor to expedite the work.

The general grade of the tunnel is easy, nowhere exceeding 3 per cent, so that high speeds for electric cars can be made through it.

It is estimated that the time in passing through, including the stop at a subway station at Laguna Honda, should be less than 10 minutes, so that the 15,000 acres of land at the southwesterly extremity of the tunnel will be brought nearer to the business center of San Francisco than either Oakland, Berkeley or Alameda.

Exhaustive borings have been made all along the route, 500 ft. apart, to determine the exact nature of the material that will be encountered in making the bore, so that the contractors will not have to bid blindly on the cost of the work.

All tubing and pipes for electric wires are carried in the concrete sidewalks and niches for operating these are spaced every 400 ft. apart.

Similar refuge niches are placed on each side, 50 ft. apart for the safety of laborers who may be working in the tunnel.

An elaborate system of ventilating is to be provided by means of separate compartment on the top of the tunnel above five feet high, through which all the foul air will be extracted by means of fans. This is superior to the single opening where cars running at high speed in opposite directions mingle the foul with the pure air.

FACTS FOR OPTIMISTS.

A New York financial house estimates that the wealth of the United States is $130,000,000,000; $50,000,000,000 more than that of any other nation. Our foreign trade balance exceeds the aggregate of 90 per cent of all other countries having favorable trade balances. This country represents 6 per cent of the world's population; we are served by over 40 per cent of the world's total railroad mileage; 67 per cent of its telephone and 20 per cent of its telegraph facilities. The capitalization of our railroads averages $64,000, whereas that of European railroads, many government owned, averages over $126,000 per mile. European freight rates average from 50 per cent to 60 per cent higher than those of the United States. Second and third class passenger rates abroad equal or exceed first class rates here. Our farmers produce 21 per cent of the world's wheat; 40 per cent of the corn and 85 per cent of the cotton. We produce 37 per cent of the pig iron, 67 per cent of the copper, 31 per cent of the lead, and are the second largest producers in the world of both gold and silver.

If our political conditions are not entirely smooth, the same is true of practically every other important country on the face of the earth. If our institutions are not substantial, our very money lacks value. If our securities are not substantial neither are our banks which invest in and loan upon them. If money is conserved through being carried in bank deposits, it is equally so by investment in the same properties that are behind the assets of the banks. If better rates can be obtained on capital invested in equally substantial enterprise anywhere else in the world, that is the place to put capital. But if, upon search, a more substantial field for investment than this country cannot be found, it is surely the part of wisdom to improve what is one of the two greatest investment opportunities of the last decade.

POLES PURCHASED, 1911.

The statistics showing the number of wooden poles purchased in the United States in 1911 by steam and electric railroads, electric light and power companies, and telephone and telegraph companies has been compiled by the Bureau of the Census.

Table 1 shows the total numbers and principal kinds of poles purchased by the several classes of consumers from 1907 to 1911, inclusive.

Table 1—Poles Purchased, Classified by Kinds of Wood: 1907 to 1911.

Kind of Wood.	1911	1910	1909	1908	1907
Cedar	2,100,144	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut	693,489	677,517	608,066	516,049	630,282
Oak	199,590	265,290	236,842	160,702	76,450
Pine	161,690	184,677	179,586	116,749	155,960
Cypress	72,995	75,459	77,677	90,579	100,368
All other	190,112	236,184	196,744	164,936	210,731
Total	3,418,020	3,870,694	3,738,740	3,249,154	2,283,268

In 1911 the total purchases amounted to 3,418,020 poles; of these, 2.402,724, or 70.3 per cent, were purchased by the telephone and telegraph companies; 787,649, or 23 per cent, by the electric railroad and electric light and power companies; and 227,647, or 6.7 per cent by the steam railroads. The total number of poles purchased represents a decrease of 452,674 as compared with 1910, and of 320,720 as compared with 1909; but it exceeds the totals for 1908 and 1907 by 168,866 and 134,752, respectively. The decrease in the purchases of 1911 as compared with 1910 was confined to telephone and telegraph companies and steam railroads, while substantial increases in purchases were reported by the electric railroad and electric light and power companies.

Five kinds of wood—cedar, chestnut, oak, pine and cypress—supplied over 90 per cent of the pole requirements of the United States during each of the five years covered by the table. The preferred species have the general physical qualifications of durability in the soil, strength, lightness, straightness, a surface which will take climbing irons readily, and comparatively slight taper. The various species of cedar combine these qualities in high degree. Cedar poles are cut principally from the white cedar of the Lake states, the red cedar of the Northwest, and the southern white cedar of North Carolina, Virginia and New Jersey. Chestnut is cut principally in the Atlantic Coast States from Georgia to New Hampshire. Oak is very widely distributed species, is cut for poles chiefly in the hardwood states of the Ohio and Mississippi Valleys. Most of the pine reported is that commonly known as southern yellow pine, and includes several species—longleaf pine, shortleaf pine, loblolly pine, and some others. Of these, the most durable is the longleaf pine, while the loblolly pine gives very brief service unless it is treated with a preservative. In the West another species—western yellow pine—is reported, which also requires preservative treatment.

Preservative Treatment.

The woods used for poles in the United States are chiefly those which are naturally very durable in contact with the soil. The life of timber under this condition varies considerably according to the species, to differences in the wood of the same species, to the character of the soil, and to climatic conditions. Cedar, chestnut, cypress, juniper, and redwood usually last

from 10 to 15 years, while white oak has an average life of somewhat less than 10 years.

The resistance of poles to decay can be considerably increased by the use of preservatives. Wood preservation is now on a firm footing in the United States, but the advantages which this practice affords are by no means fully utilized by pole consumers. Preservatives not only add from 3 to 15 or more years to the service of the woods now commonly used for poles, but also make it possible to use cheaper woods which in their natural condition lack durability in the soil although possessing all the other qualities necessary in pole timber. The durability of woods which ordinarily last but a few years can thus be increased to more than double the normal life of cedar.

Poles may be treated by the application of the preservative to the entire pole or only to those parts which commonly decay rapidly in the locality in which it is used. The preservative may be applied with a brush; the pole may be dipped or stood in an open tank containing the preservative; or the entire pole may be inclosed in a cylinder full of a preservative and subjected to sufficient pressure to cause it to penetrate the wood. In the United States poles are commonly treated simply by the application of one or two coats of the preservative with a brush. This is the cheapest and most convenient method, but also the one which adds the least service, since the penetration of the wood by the chemical is usually relatively slight. A comparatively small number of poles are treated in open tanks or in closed cylinder tanks and the wood thus much more thoroughly protected. About 181,000 linear feet, or the equivalent of 7240 poles 25 ft. long, were treated in tanks in 1911.

The total number of poles which received some kind of treatment in 1911 was 656,504, or 19.2 per cent of the total number purchased. In 1910, 824,673 poles were treated, or 21.3 per cent of the total number purchased in that year.

Practically all the poles were treated by the less effective methods, which add but relatively few years to the service of the wood. Of the total number treated, cedar poles constituted two-thirds, and cedar, yellow pine, and chestnut poles together amounted to 91.8 per cent. From this it is apparent that treatments were applied principally to durable species. Less than 100,000 poles of the less durable species, which include some of the species classed under yellow pine, all of the western pine, white pine, and tamarack, were treated. It is apparent that the opportunities which exist for making first-class pole timbers from the less durable woods are not being utilized to any considerable extent, and that pole consumers have first turned their attention to increasing the durability of the woods which they have already been using. Loblolly pine of the Southern states, lodgepole pine, western pine of the Rocky Mountain region, and many other woods deserve careful consideration as prospective pole timber, since they take treatment readily and in many places offer consumers a chance to use local woods instead of shipping poles from distant regions at considerable cost.

The principal preservatives used for treating poles are those classified as refined coal-tar oils. Under this heading are included creosote oil and various proprietary preservatives reported as carbolineum, C. A. Wood Preserver, S. P. F., and others. The bulk of the poles in this class were treated with the proprietary preservatives. Creosote oil was used in treating 159,321 poles, of which 50,021 were cedar and 83,035 yellow pine.

Wood preservatives properly refined from coal tar are considered among the most effective known when properly applied. Coal tar was used in the treatment of 43,659 poles, three-fourths of which were cedar.

Over 14,000 poles were treated with paint—a preservative concerning the effect of which little is known. Judging by tests which have been made on greenhouse timbers, probably two or three years' life is added by the use of paint.

Charred poles in experimental lines have shown less decay than untreated poles. Poles are often charred by painting them with crude oil and burning the oil. Crude oil alone has proved a valuable preservative when the wood was thoroughly saturated with it, but when the poles were merely painted with this preservative, or the oil used in quantities around them when they were set, the results have proved unsatisfactory.

The cost of treating poles varies according to the wood treated, the kind of preservative and quantity used, and the process employed, but it is only in rare instances that the adoption of a pole-treating policy is not economical. The United States Forest Service has a large number of poles treated by different methods under record and subject to annual inspection in order to determine the relative values of the different methods and preservatives.

Oil pipe lines are not common carriers according to a recent ruling of the Federal Court which finds the regulation unconstitutional which places them under the jurisdiction of the Interstate Commerce Commission.

The value of "n" in Kutter's formula for water flowing in open concrete lined and earth canals has been determined from a large number of observations by the U. S. Reclamation Service. The nature of the data does not justify the formulation of general conclusions as to the proper value of "n" to be used for different materials, but the values heretofore generally used, namely: .012 to .014 for concrete and .020 to .025 for earth channels, seem to be substantiated.

An electrically-heated school house is to be built at Rupert, Idaho, the principal town on the North Side Minidoka reclamation project, current being supplied by the U. S. Reclamation Service. Fresh air will be blown over the heating elements and thus ventilation will be secured with heat. The school will also have a household economics room equipped with a large electric range and 12 individual electric stoves. There will also be a large water-heater for supplying hot water for all purposes in the building, including the baths for the gymnasium. The lighting system will include provision for a moving picture machine in the auditorium.

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
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· FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Regulations for Line Construction in Oregon

In accordance with the plan that all electrical construction be "just reasonable and safe" the Oregon Railroad Commission has issued tentative regulations governing overhead and underground construction of telegraph, telephone, signal, trolley and power lines in the State. The provisions are so nearly identical with those in California as to lead to the conclusion that one formed the model for the other, with certain improvements which have been suggested by use.

In the main these rules are good. While they increase the cost of construction they minimize the chance for accident. Freedom from accidents, whether to materials or men, is the one factor above all others that makes for success in supplying power, light, transit or communication. Anything which promotes safety should be welcomed with open arms. Substantial line construction, careful location of wires and ample clearances prevent many accidents.

Experience has shown that the fifteen-inch clearance between any wire and pole gives sufficient climbing space so that none but a careless lineman is in danger. The wisdom of the grounded neutral is also admitted, as well as the requirement that all high-voltage wires be short-circuited and grounded while men are at work on them. No serious objection can be raised against these requirements but to require a six-foot clearance for all voltages between 600 and 15,000 works an unnecessary hardship on many 2200 volt distribution systems. The recognition of 6600 volts as an intermediate voltage would thus make a four-foot clearance equally safe.

The Oregon Commission also displays a commendable desire to act in a just and reasonable manner by giving the companies an opportunity to file any protest to this tentative order. While their foresight can prevent accidents, it cannot always anticipate objections. Proper co-ordination of their efforts should do much to strengthen both the commission and the company in public esteem.

Lumbering Electrically

The application of electric power to lumbering represents not only the greatest single advance which has yet been made in that industry but also the most notable victory in the campaign for the industrial utilization of electricity. The difficulties have been many. Enormous fluctuations in demand for power, great variation in material to be handled and sudden changes in the speed of machines, makes the problems of proper control almost as difficult as those of motor adaptation. New means have been devised and old methods superseded in the face of the opposition of many lumbermen, proverbially the most conservative of men. Because the steam engine had sufficed in the past was sufficient reason for its persisting in the future. Coupled with this conservation there has existed a disregard

for human life, a carelessness as to the timber loss, and an indifference as to power efficiency which have made lumbering the most wasteful of all work.

But the errors of conservatism are now being overcome by the truths of conservation. Safety devices are being introduced into the mills and camps, by-products are made from former refuse, fires are fought and power saved. With a central plant power can be generated and distributed far more efficiently than by portable engines and boilers, where scale removal and fuel saving are seldom tried. By this means also boiler explosions and forest fires may be minimized, especially where the "donkey-man" performs other duties which take his eye from the water-gauge and his hand from the damper. Individual motor drive is far more economical than the maze of belts, hangers and pulleys required to transmit power from a steam engine; it also removes an ever-present danger to life and limb. In fact, electricity is safe, cheap and convenient, the ideal power for the lumberman.

Of the many articles which have been published in these columns regarding electricity in the saw mill, electrical logging and other application, that in this issue represents the greatest advance which has yet been made in the application of electric power to the planing mill. Credit is due to the engineer who worked out the details of this installation and honor must be accorded the business man whose faith has made it possible. It has not always been easy to get the money for such radical changes. The laurels belong to such men as Everett G. Griggs, president of the West Coast Lumber Manufacturers' Association, and a consistent advocate for electric drive, whose example has inspired others to dovetail their efforts with his to bring about the complete electrification of the lumber business.

Denial of Rumors

Various rumors have been circulated during the past week regarding the Pacific Gas & Electric Company and the Great Western Power Company. Fact and fancy have been so interwoven that a statement of a few authoritative facts seems advisable. The contract whereby the Pacific Gas & Electric Company purchased 25,000 h.p. from the Great Western Power Company has been renewed, pending the completion of the former company's Lake Spaulding development. Construction is being pushed on the Spaulding dam so that sufficient water will be available for several units to be installed in the Drum power house by the beginning of 1914, a force of about two thousand men now being at work. Due to the stringency in the money market work has been discontinued on other parts of this development in order that all possible resources can be concentrated on the early completion of the Drum power house. The diminished efforts at Lake Spaulding are in no way concerned with a possible merger between the two companies.

Rates

The old fallacy of a uniform charge to all electric consumers, after having been repeatedly downed, is again being proposed as a means of preventing rate discrimination by electric companies. The refuting facts have been told so often as to make their repetition almost monotonous, yet their reiteration seems necessary to demonstrate the absurdity and inconsistency of such a proposal.

To impose the same charge for all kinds of service to all classes of consumers is to ignore the first principal of business, which bases price on cost. It costs as much to build a pole line to a small cottage as to a large factory an equal distance from the plant. The cottage takes little current, but takes it at a time when the system is most heavily loaded; the factory uses most of its power at times of least demand. Few people realize how much apparatus must be kept in reserve to meet their needs at any time of the day or night. This may be likened to keeping a garage filled with idle automobiles instantly ready with a driver at the request of any or all the people at any time. Alternating current cannot be stored, but must be generated on demand. Readiness to serve this demand means an enormous initial cost of equipment, and it costs almost as much to run it lightly loaded as at times of heaviest load.

The expense is necessarily divided among the users. If some factory or electro-chemical works can employ the available unused power at times of light demand, it will naturally lessen the average charge to other consumers. But to charge such a large consumer the same rate as is borne by the short-hour consumer would make the price prohibitive. Enforcement of a uniform high rate would in this way defeat its own purpose and ultimately restrict the sale of central station current to the small consumer. On the other hand, it is commercially impossible to sell current to the small consumer at the low price now given a large off-peak consumer.

The foregoing is argued upon the assumption that supplying electricity is like any private business which depends upon selling goods at wholesale more cheaply than at retail. While this has been true in the past, the question is now being raised whether a railroad, a telephone or a power company is not more public than private in nature. The establishment of various regulating commissions has been one result of the feeling that they are private agents conducting public business.

While the public concedes the necessity for rate discrimination in private business, it demands equality of rates for public service. The postal and customs services are examples of federally owned businesses giving equal rates to all, the telegraph and railway business exemplify the situation under private ownership. Electric light and power companies will ultimately also be obliged to recognize the public quality of their management as paramount to the private quality. But until this time comes, the obligation to stockholders compels the company to make different charges to different classes of consumers.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. A. Sayles, Holabird-Reynolds Company's San Francisco office, was in Sacramento this week.

A. L. Orman, local auditor General Electric Company, was in Seattle recently on a ten day business trip.

R. W. Nicol, manager of the Salt Lake Electric Supply Company, has been at Denver on a short business trip.

H. R. Noack, president of Pierson, Roeding & Company, San Francisco, has returned from an extended trip East.

E. C. McBrearty, of the American Electric Heater Company, Detroit, Mich., is at San Francisco on his semi-annual trip.

J. W. Thompson, H. W. Johns-Manville Company's San Francisco office, is spending a pleasant vacation in Yosemite Valley.

P. B. Hyde, representing Thomas A. Edison, has returned to San Francisco, after a short trip through the northwest.

J. B. Shay, chief stores manager Western Electric Company with headquarters in Chicago is making an inspection tour of western branches.

Grover Anderson, who represents the Electric Appliance Company in Arizona, is at his home in San Francisco recovering from an attack of typhoid fever.

G. W. Van Auken of Cache county has moved to Pleasant Grove to work for the Utah Power & Light Company at their Battle Creek plant, near Salt Lake City.

E. M. Cutting of the Edison Storage Battery Supply Company, left during the week for an extended trip taking in California and the north Pacific Coast states.

Fred A. Wood, northwest manager Gamewell Fire Alarm Telegraph Company, with headquarters at Seattle, is making a two weeks' business trip to Southern Alaska points.

C. O. Poole of the Southern Sierras Power Company, Los Angeles and Mr. Chatfield, manager of the Nevada-California Power Company, at Bodie, were recent visitors at San Francisco.

J. D. Hull, Seattle, actively engaged in power installation work, is making a three weeks' business trip to the east and will visit New York, Chicago and other points during his absence.

J. F. Perry, former salesman Wagner Electric Manufacturing Company, has become connected with the Krogh Manufacturing Company, San Francisco, as general sales manager.

L. Heyneman, manager Pacific Coast branch Goldschmidt Thermit Company, has returned from Los Angeles and San Diego where he has been in connection with work done for the San Diego & Southeastern Railway.

V. A. Welman, chairman of the Seattle Jovian degree team committee, has resigned and **L. L. Brown** of the Western Electric Company, was selected to take his place. This committee is making active preparations for the rejuvenation to be held on September 4.

A. H. Noyes, who resigned his position with the Electric Appliance Company some time ago, to go into the electrical contracting business, has given up his business at Grants Pass, Ore., to accept a position with this company and will represent them in Washington, Oregon and northern California.

W. C. Orem, president of the Salt Lake and Utah Railroad, has just returned from the East where he placed orders for cars and equipment for the interurban line now in course of construction south from Salt Lake City into Utah county. He reports that the new road should be ready for business at least between Salt Lake and Provo by January 1, 1914. The interurban cars which he ordered last week will contain many features new to this region. Among others, it is proposed to provide a buffet dining compartment on some of the cars. They will be geared for a maximum speed of sixty miles an hour.

O. A. Honnold and **L. L. Dagron**, engineer of the Utah Light & Railway Company, were in Ogden recently inspecting the reconstruction of the company's pioneer plant located at the mouth of Ogden Canyon. New and improved water wheels, buckets and generators have replaced the ones originally installed when the plant was started in 1896. An eight-acre equalizing reservoir, which will enable water to be stored during the daylight hours, has been built below the plant. When these improvements are completed, the capacity of the plant will be increased from approximately 3200 to 5200 kw. for peak purposes.

OBITUARY.

Morris Fretwell, a maintainer in the signal service of the Southern Pacific Railroad, touched a high tension wire on top of a pole at the intersection of the railway line and Twenty-first street, Ogden, and was instantly killed. The eleven thousand volt line with which he came in contact, supplies energy for the block signal system extending west from Ogden and across the Lucin cutoff.

H. J. Woebke, sales agent for the Salt Lake branch of the American Steel and Wire Company, was killed in an automobile accident in Salt Lake City on the evening of July 30th. He was pinued beneath the car after tipping over and sliding down a twenty-foot embankment, and died at the emergency hospital about an hour after the accident. O. W. McGill, travelling agent for the Salt Lake Hardware Company, who was driving the car, sustained a broken rib

H. J. Woebke

and internal injuries, but his chances for recovery are good. Mr. Woebke was a member of a well-known California family, a native of San Francisco, and is survived by brothers and sisters in that city. He came to Salt Lake City as representative for the American Steel and Wire Company six years ago. Mr. Woebke was a member of the Commercial Club of Salt Lake City, the Utah Electric Club, and the Jovian Order. Funeral services were held in Salt Lake on July 31st. Mr. Vin Conely accompanied the remains to San Francisco.

MEETING NOTICE.

Electrical Development and Jovian League.

The entertainment committee of the League, A. E. Rowe, chairman, has arranged for a number of interesting meetings. For the first meeting (September 2), Robert Newton Lynch, executive head of the Chamber of Commerce of San Francisco and the California Development Board, is to address the members. Mayor James Rolph Jr. is scheduled to speak at the meeting on September 30th. Jovian Day is set for September 23 and Statesman A. H. Halloran is taking care of the events of the day. There will be no meeting on September 9, it being a holiday, and the business meeting which would ordinarily be held on that date, has been set for Tuesday, September 16.

TRADE NOTES.

The Salsich Lumber Company of Salsich, Washington, has purchased a 100 h.p. General Electric motor to operate a John K. Miller blower.

Hunt, Mirk & Company, Inc., San Francisco, are making an extension to the steam plant of the United Light, Fuel & Power Company at San Diego.

The Industrial Engineering Company, Oakland, Cal., recently changed the installations of the Monarch Oil Company from direct to alternating current when the plant was abandoned in favor of central station service.

The Allis-Chalmers Manufacturing Company has just closed a contract with the Oregon Lumber Company of Dee, Oregon, for an electrically operated saw and planing mill at Dee. About 800 h.p. of induction motors will be installed.

Buxbaum & Cooley, Seattle, are putting a 70 point annunciator on the steamer Solduc and are also putting new electrical equipment in the steamer Harvester and overhauling the electrical equipment of the steamer Navajoe.

The Skinner Engine Company recently installed two of its horizontal center crank engines at the Monroe state reformatory direct connected to two Allis-Chalmers generators of the three-wire type, 75 and 100 kw. respectively.

The Seattle branch of the Pacific States Electric Company has recently supplied a number of cities, including Cashmere and Aberdeen, Wash., with the Union Metal Manufacturing Company's steel street lighting standards.

Nixon Kimmel of Spokane has awarded to Pierson, Roeding & Company, Seattle office, contract for aluminum cable and insulators for his irrigation project in southern Washington.

Kilbourne & Clark Mfg. Company, Seattle, were the low bidders on wireless telegraph apparatus for which bids were opened in Washington July 29 at $64,410. The equipment consists of 15-5 kw. sets to be delivered at the navy yard, New York.

The National Tube Company, Pittsburgh, Pa., announce that they will enter the electrical conduit field. They have secured the National Metal Molding Company and the Safety-Armorite Conduit Company, both of Pittsburgh, Pa., as their agents to manufacture and sell this product.

The Line Material Company, South Milwaukee, Wis., manufacturers of insulator brackets, outdoor lighting brackets, and other line construction material, announces the establishing of a western office at 229 Sherlock Building, Portland, Oregon. Offices have also been established at 114 Liberty street, New York and at 915 Olive street, St. Louis, Mo.

W. R. Hendry & Company, Seattle, have charge of the complete electrical installation for the Issaquah Coal Company, Ltd., at Issaquah, Washington. The plant will consist of a number of induction motors for operating the tipple, washing and screening plants. An Ingersoll-Rand air compressor driven by a 300 h.p. synchronous motor is being installed together with an electric haulage system.

FINANCIAL NOTES.

The Tacoma Railway & Power Company, a Stone & Webster concern, has filed its semi-annual statement showing its power business for the first half of 1913. The total business transacted amounted to $35,370. The passenger street car business for the first six months of 1913 shows an aggregate amount of $419,166. The Pacific Traction Company's report for passenger business shows a total of $36,939, while the freight business amounted to $28,198, and the freight business amounted to $314.

The Utah Securities Corporation has made a call of the ten-year six per cent notes of that corporation. This makes sixty per cent in calls made upon the underwriters, the last previous call having been of five per cent on June 23d. In the fall of 1912 $27,000,000 of these six per cent notes were underwritten by a large syndicate, and at that time it was not expected that more than thirty per cent of the amount subscribed would be called, as it was thought that the notes would be retired by the sale of bonds of the Utah Power & Light Company. The stringency of the money market and the lack of the demand for bonds especially of new issues, have prevented the expected refunding of the notes.

The Pacific Gas & Electric Company has applied to the Railroad Commission for authority to issue $5,000,000 of convertible general lien bonds in place of the $5,000,000 convertible debentures previously authorized by the commission. The effect of this is merely to change the form of the debenture mortgage. The company asks for authority to pledge for notes these general lien bonds and the $5,000,000 first and refunding bonds previously authorized. It is proposed that the aggregate amount of such notes shall not exceed $7,000,000, and that they shall mature in June, 1914. The company asks also for authority to issue notes for $1,192,500 at this time which shall be taken up by collateral trust notes. The purpose of the company, in general, is to pledge the $10,000,000 bonds and to use the proceeds for the prosecution of work upon its Bear River development and for general expenditures over its system. These are the purposes for which the $10,000,000 in securities were authorized.

The Western Power Company has sold to William B. Bonbright & Company, Inc., $1,250,000 collateral trust 6 per cent two-year notes, dated July 18, 1913. The notes are being offered at 98 and interest or on a 7 per cent basis. As security there have been deposited $849,000 par value Great Western Power first 5s, $533,000 par value City Electric first 5s, $700,000 par value California Generating Company 6 per cent preferred stock, a total of $2,082,000 of collateral. At market prices this collateral is in excess of 25 per cent above the amount of notes to be issued under it. Western Power's balance, after charges and guaranteed dividends for the year ended June 30, 1913, was $396,002, or approximately five times the requirements for these notes.

For the first five months in 1913 Los Angeles Gas & Electric increased gross earnings $320,322, or 17 per cent, while net earnings for the same period increased $150,000 or 17 per cent.

Santa Barbara Gas & Electric for four months ended April 30, 1913, increased its gross $4757, or 4 per cent, while net increased $11,300, or 12 per cent, operating expenses having been decreased by $6456, or ½ of one per cent.

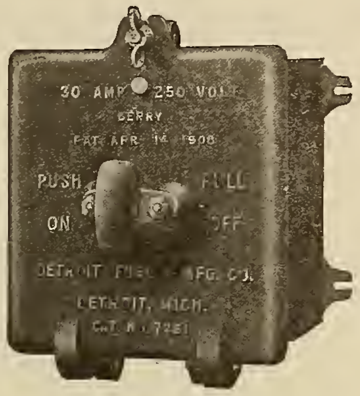
NEW CATALOGUES.

"Automatic Electric Cooking" is the title of a new illustrated booklet recently issued by the Berkeley Electric Cooker Company, Berkeley, Cal. The economy and cost of electric cooking is discussed from a practical standpoint. The booklet contains a clear explanation of the operation of this company's Type C cooker and shows its possibilities as a central station load builder.

INDUSTRIAL

IRONCLAD ENCLOSED FUSED SWITCHES.

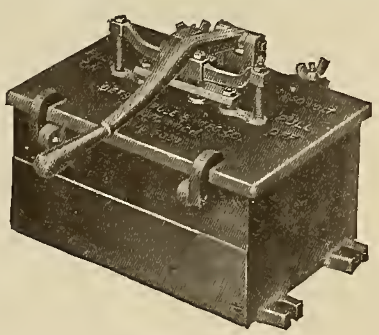
A line of ironclad enclosed fused switches developed by the Detroit Fuse & Manufacturing Company of Detroit, Michigan, employs an entirely new principle of knife construction. They comprise a suitable cast iron case with rabbeted, rubber gasketed, and hinged door or cover which is provided with hinge bolts and wing nuts for locking and sealing. The switch mechanism is of the spring actuated double break plunger type, controlled from the outside of the cast iron enclosing case, without any possibility of accidental contact.



Ironclad Fused Switch.

These switches are quick-make and quick-break. The capacities which are now ready for the market involve the double and triple pole type, up to and including 200 amp., 250 volt, and have been approved by the Underwriters' Laboratories.

This line also includes an a.c. starting switch, a distinctly new ironclad device designed to overcome any occasion to follow the dangerous and oftentimes costly practice of over-fusing a.c. motors. By its use it is possible to fuse these motors for their running load, the fuses being paralleled by automatically removable short circuiting bars, which are in circuit with the fuses only when the switch is in the starting position. The switch may be sealed shut to protect it against tampering, or the possible use of fuses of too large capacity.

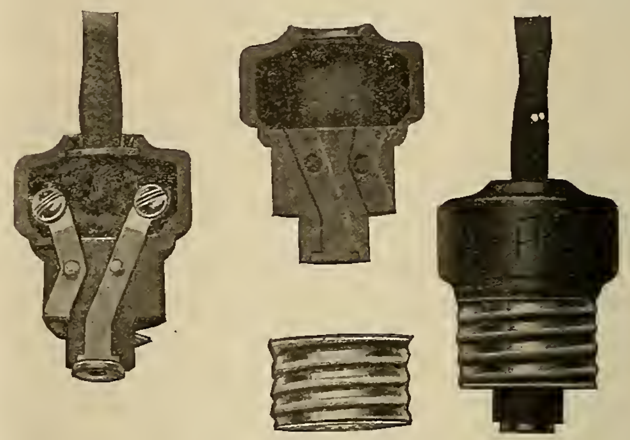


A. C. Starting Switch.

To start the motor, the starting lever is thrown in as far as possible; this operation switches the motor directly on to the service and at the same time connects the short circuiting bars in shunt with the fuses. It is necessary to hold the starting lever in this position until the motor has attained full speed, when the hand may be removed from the starting lever. A spring actuated spreader carrying the fuse short circuiting bars is automatically withdrawn without opening the circuit, leaving the fuses themselves in circuit. To stop the motor, all that is necessary is to pull the lever toward the operator, which opens the circuit by removing the fuse connections therefrom.

NEW CUTLER HAMMER "SPLIT" ATTACHMENT PLUG.

The saving of time in wiring the new No. 7605 "Split" attachment plug marketed by The Cutler-Hammer Manufacturing Company of Milwaukee is the feature of greatest importance, especially to the manufacturer using many plugs with his product. While having the appearance of a solid plug, it separates into halves, facilitating wiring. Removing the screw shell of this "Split" plug allows it to be separated



"Split" Attachment Plug.

into two halves exposing large binding screws for securing the cord. This can be easily and quickly done. Unlike other solid plugs, there is a large space for the knot. The method of locking the screw shell in place after the cord has been secured and the halves placed together is very ingenious. The bottom of the screw shell has a large number of crescent shaped perforations one of which when the shell is screwed in place engages with a latch, securely locking the shell in place, preventing it from being turned backwards and holding the plug halves together. A friction wiping contact entirely independent of the locking latch makes electrical connection with screw shell.

The plug is sent out with the screw shell in place but not locked so that it is only necessary to unscrew the shell and wire the plug, after which the halves are placed together and the shell screwed on until locked. If it is desired to unlock it at any time a pen knife or screw driver can be used to press the latch down which permits unscrewing the shell.

Black heat-resisting thermoplax is used for the body of the plug, which is of neat, substantial appearance. The small size makes it at once suitable for a great variety of uses for which separable cap plugs are not required. The illustration show the simplicity of this device and indicate the method of taking apart for wiring. A reducing bushing is provided so that ordinary, reinforced or silk cord may be used.

AUTOMATIC PACKAGE TIER.

One of the latest labor saving devices to make its appearance is the automatic package tier. It is designed primarily for tying mail matter into packages, but has many other applications besides. It takes bundles of from 25 to 50 letters, and in 2½ seconds binds them into a neat, compact package and drops them into the mail bag or other receptacle. Where much mail matter is handled, it permits a reduction of the clerical force and enables earlier mails to be caught. The machine is made by the Automatic Package Tier Company of Chicago, Ill., and is operated by a 1-8 h.p. Westinghouse small motor which takes current from the lighting circuit.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—The Hydraulic Clutch Company, with a capital stock of $500,000, of which $400,000 has been subscribed, has been incorporated in this state by A. J. Clipper, A. H. Jessen and J. H. Fairfield. A new plant will be started at once.

SAN DIEGO, CAL.—Articles of incorporation of the Cuyamaca Water Company, with capital stock of $1,000,000 have been filed. Investigations of complaints against the company will be started by the State Railroad Commission at once. J. A. Murray and Col. Ed. Fletcher are the principal stockholders of the company.

ILLUMINATION.

TACOMA, WASH.—The St. Paul & Tacoma Lumber Company will build an 1800 h.p. isolated power plant to cost $10,000.

TWIN FALLS, IDAHO.—This town is taking figures for the installation of a street lighting system. Approximately 90 street lighting standards will be used.

CLATSKANIE, ORE.—Additional equipment will be added to the electric light plant here which has recently been obtained by a syndicate of which W. W. Seymour of Tacoma, Wash., is the head.

LOS ANGELES, CAL.—The Suburban Homes Company contemplates turning over its boulevard to the county so as to obtain permission from the supervisors to form a lighting district to territory, including the boulevard. It is desired to install ornamental lights along the entire roadway.

MADERA, CAL.—George W. Kitchen and John Beals of Los Angeles have completed the new gas plant for this town. The plant has a capacity of 10,000 ft. per hour and a storage capacity of 30,000 ft. Four-inch mains and two-inch laterals have been laid through the new townsite. The cost of installing the plant and laying the mains was $25,000.

SACRAMENTO, CAL.—The commissioners have unanimously resolved that an appeal to the supreme court for a ruling on the legality of the $2,633,000 bond issues providing for the extension of the water mains, the electric light plant and the hall of justice offered the best solution of the difficulty in determining the validity of the issue.

REEDLEY, CAL.—The franchise for supplying this city with gas has been sold to the Alta Gas Company. The necessary material for installing the plant will be ordered at once and the work will begin immediately. The franchise provides that the company is to furnish gas for lighting and heating purposes at a rate not to exceed $1.25 per 1000 cu. ft.

MARSHFIELD, ORE.—The Oregon Power Company has made a 28 per cent reduction in its rates on electricity here to go into effect as soon as the Oregon Railroad Commission approves the new schedule. The company recently took over the electric franchises at Coquille and Myrtle Point and intends supplying current from a central plant at Marshfield to North Bend, Marshfield, Eastside, Coquille, Myrtle Point and other towns in the county.

TRANSMISSION.

DAVENPORT, WASH.—The Washington Water Power Company, Spokane, has been granted a 50-year franchise by the county commissioners to operate power and lighting lines to Creston, Wilbur and Almira.

REDLANDS, CAL.—Work begun last year upon the Baldwin power plant, in Mill Creek Canyon, east of Forest Home, will soon be resumed. It is planned to build a $350,000 power house and develop 2500 horsepower.

PHOENIX, ARIZ.—The contract for construction of the Crosscut power house at Hole-in-Rock, has been let to Marin & Gallis by the board of governors of Salt River Valley Water Users' Association. The cost will be about $42,000.

WASHINGTON, D. C.—Authority for the development of an electric project, with an ultimate capacity of 359,000 h.p. on the Pen d'Oreille River, Washington, has been granted to the International Power & Manufacturing Company.

MARTINEZ, CAL.—A contract has been awarded to H. R. Ingram of this city by the Pacific Gas & Electric Company for the construction of a reinforced concrete and steel electric substation at the Associated Oil plant on Avon. Power for the refinery will be supplied from this section, which will house five transformers.

AUBURN, CAL.—A deed has been filed here whereby the Pacific Gas & Electric Company takes over the rights, reservoirs, ditches, etc., of the United Water & Power Company in Placer county. The purchase of the United company's property was of importance to the Pacific company's plans of enlarging its system in Placer county.

BOISE, IDAHO.—State Engineer John H. Lewis of Oregon made a proposal to the State of Idaho, through Governor John M. Haines, for Idaho and Oregon, with the assistance of the Federal Government, to work co-operatively to secure information on which to base legislation that will result in the development of power to lift water to high lands along the Snake River for irrigation purposes, and at the same time form locks to make the river navigable both east and west from Huntington. In Snake River between Huntington and Lewiston there is a fall of about 1300 ft. With the construction of dams to utilize this fall approximately 800,000 horsepower can be developed.

TRANSPORTATION.

SEATTLE, WASH.—The Board of Public Works will receive bids until August 21 for trolley wire for the municipal railway.

SAN DIEGO, CAL.—The Los Angeles & San Diego Beach Railway, commonly known as the La Jolla line, of which E. S. Babcock is president, will be transformed into an electrical trolley line as soon as possible.

LOS ANGELES, CAL.—Specifications for forty-five all-steel passenger cars that the Pacific Electric is to order shortly are nearing completion. These cars will be ordered as part of authorization of $1,554,911 for the purchase of rolling stock.

SAN FRANCISCO, CAL.—An announcement of the special bond election to be held next month for the issuing of $3,500,000 in bonds for the purpose of constructing a system of municipal railways was authorized in a resolution adopted by the supervisors.

COLTON, CAL.—In order to provide a short cut-off, the Crescent City electric line will be connected with the Southern Pacific road at Bloomington, according to present plans. A switch will leave the trolley line a short distance from the present terminus on Cedar avenue.

OAKLAND, CAL.—All-steel, center entrance, pay-as-you-enter street cars of an entirely new type were placed in service by the Southern Pacific Company when it started its cross-town line on August 1st. Passengers board and leave the cars by three doors set in the middle of the car on the side.

SAN DIEGO, CAL.—A car barn of concrete and hollow tile, occupying a ground area of 200x300 ft. and having a storage capacity of 100 cars, will be erected immediately on University Heights by the San Diego Electric Railway Company. The plans are being prepared in the office of Engineer Andrew Ervast.

SALT LAKE CITY, UTAH.—Dr. E. D. Woodruff, president of the Commercial Club, Joseph Geoghegan, aud other prominent residents of Capitol Hill, have presented a petition to the Utah Light & Railway Company requesting that passenger service be instituted on the freight line which runs up Capitol Hill and to the new Capitol grounds.

PRINEVILLE, ORE.—After negotiations covering practically a year, a final contract has been closed by the citizens' committee and H. P. Shell of Tacoma, Wash., for the construction of a railroad from Metolius to Prineville. Preliminary work will be commenced at once and construction of the road will follow immediately.

SAN FRANCISCO, CAL.—The city attorney has been authorized by the supervisors to file an application with the attorney-general for the revocation of the franchise held by the United Railroads enabling it to operate an extension on the Post street line into Market street. The franchise stipulated certain work to be done within a limited period, with which, it was said, the railroad had not complied.

SEATTLE, WASH.—David Swank has asked the city authorities of Seattle and the King county commissioners for an extension of the franchise granted to him by the county commissioners five years ago for constructing an interurban railway from Seattle to Everett. Part of the territory involved has been annexed to the city since the franchise was granted. Some work has been done on the grades but not enough to keep the franchise alive, same expiring in September.

TELEPHONE AND TELEGRAPH.

TOMBSTONE, ARIZ.—The Navajo-Apache Telephone Company is making arrangements to extend and improve its lines and will open exchange offices at Concho and Springerville.

SAN FRANCISCO, CAL.—A resolution has been passed by the supervisors providing $1500 from the urgent necessities fund of 1912-13 for the use of the city attorney in the pending telephone rate litigation.

YUBA CITY, CAL.—Upon the application of the Colusa Telephone Company for a franchise to build its lines into Sutter county the supervisors have made an order that the franchise be sold to the highest bidder on September 15th.

BISBEE, ARIZ.—The Mountain States Telephone & Telegraph Company, to meet increasing demand for long distance service to the east, will install a second wire between Bisbee and El Paso, which will serve all southern Arizona points. Work will be started soon.

PORTLAND, ORE.—Federal Judge R. S. Bean, sitting at Portland on July 31st, denied the plea of defendant telephone companies for delay until October 31st in the filing of their answer in the suit brought by the government to dissolve the alleged telephone trust and ordered that the answer be filed not later than September 15th.

REDLANDS, CAL.—The Southwestern Home Telephone Company, with headquarters here has filed a complaint with the commission against the Southern Sierras Power Company, charging that the latter has erected its poles in undue proximity of the poles of the Southwestern Home Telephone Company.

BERKELEY, CAL.—The supreme court of the state will pass on the merits of the controversy between the city of Berkeley and the Pacific Telephone Company relative to the forfeiture of the bonds of the Home Telephone Company when it was merged into the Pacific Company. City Attorney Staats has filed notice of an appeal from the decision of the superior court favoring the corporation.

SEATTLE, WASH.—The Western Union Telegraph Company through its representative E. L. Ritter of Seattle has made the first objection that has yet been offered to the provisions of the law regulating power and transmission wiring. He contends that the new law is not drawn to apply to telegraph wires in the provision relating to more than 300 voltage, explaining that on quadruple work the wires of the Western Union sometimes carry more than this voltage.

WATERWORKS.

NORTH BEND, ORE.—The Simpson Lumber Company has been granted a franchise here to install a water system to supply fresh water for its mills and factories.

OLYMPIA, WASH.—Bids will be received up to September 3d by I. N. Holmes, city clerk, for the purchase of $150,000 in bonds, the proceeds to be used in the construction of a water system.

OXNARD, CAL.—The voters of Oxnard have decided to purchase the water plant and system of the Ventura County Power Company, paying therefor the $30,000 bond issue of municipal street lighting bonds. Transfer of the plant to the city will be made as soon as the legal steps necessary can be taken.

TACOMA, WASH.—With plans prepared by Engineer William B. Short of the Water Department for cutting over all of the South Tacoma mains, a general overhauling of the water mains in the city has begun. About 20 miles of larger mains will be laid in the West End and around Fern Hill. The cost will be approximately $100,000.

ROUNDUP, MONT.—Engineer Henry Gerharz, after a two months' examination and survey of the water property submitted the estimated value of the plant at $32,861.67. He also estimates that a plant could be built including a storage reservoir of 500,000 gallons for $45,050.86, that would give much better satisfaction than the present one. Improvements which would be necessary to bring the plant up to its full efficiency would cost $19,508.32.

HARRISON, IDAHO.—An election will be called as soon as possible to vote on the question of municipal ownership of the water system. The first question is whether the city shall be bonded for $15,000, with which to purchase and maintain a waterworks system; the second whether the council shall proceed to buy from the First National Bank the system at a cost of $10,000, and the third will be the question of the installation of a separate and new system.

SEATTLE, WASH.—Judge Preble of the superior court of Yakima county, Washington, has sustained the order made by the public service commission of Washington, which required the Pacific Power & Light Company to build a storage reservoir and pipe lines at a cost of $244,000. This company supplies water to the city of North Yakima and on the grounds that the water supply of the city was impure and the fire pressure insufficient the commission made its ruling.

SAN DIEGO, CAL.—Joint development by the city of San Diego and the municipal water district of La Mesa all all waters of San Diego River was proposed and discussed at a conference between city officials and the directors of La Mesa district. La Mesa proposes to issue bonds to the extent of $750,000 or $1,000,000. San Diego's share of cost will be determined later. The project involves the construction of a reservoir in El Capitan dam site, reservoir at site of the Old Mission dam, with combined storage capacity of 20 billion gallons of water.

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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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Where to Buy It in the West, Pages 9, 10.

Alphabetical Index to Advertisers, Page 8.

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VOLUME XXXI SAN FRANCISCO, AUGUST 16, 1913 NUMBER 7

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CONSTRUCTION OF THE MIDWAY GAS LINE

BY W. E. BARRETT.

A huge pipe line transporting natural gas developed in the Midway oil fields in Kern county, across the plains and over the mountains to the city of Los Angeles, is described by the author in the San Joaquin Light & Power Company's magazine. This line is the property of the Midway Gas Company and in its completed form presents the realization of a project which has called for an immense amount of effort and preparation and a fine brand of courage on the part of those who made the enterprise possible. First of all, after the discovery of the natural gas field, it was necessary to determine if the underground supply was sufficient to warrant the expenditure of so large a sum of money as is represented by the construction of this line and the other activities contingent with putting the service into effect. A satisfactory report obtained after many months of hard effort, the next step was the selection of a route for the carrier. The geographic location of the extremities of the line are on either side of a rough and rugged portion of the Coast Range mountains leading up to which are stretches of plain. Hence it was a certainty that the mountains would have to be crossed and the problem was to find the most feasible and practical route. In the survey of this and the construction of the line, a great many conditions were experienced which are not paralleled in any other section of the country.

Work Done by Ditching Machine on 3 Per Cent Curve and 4½ Per Cent Grade Near Newhall Tunnel in the Los Angeles Division.

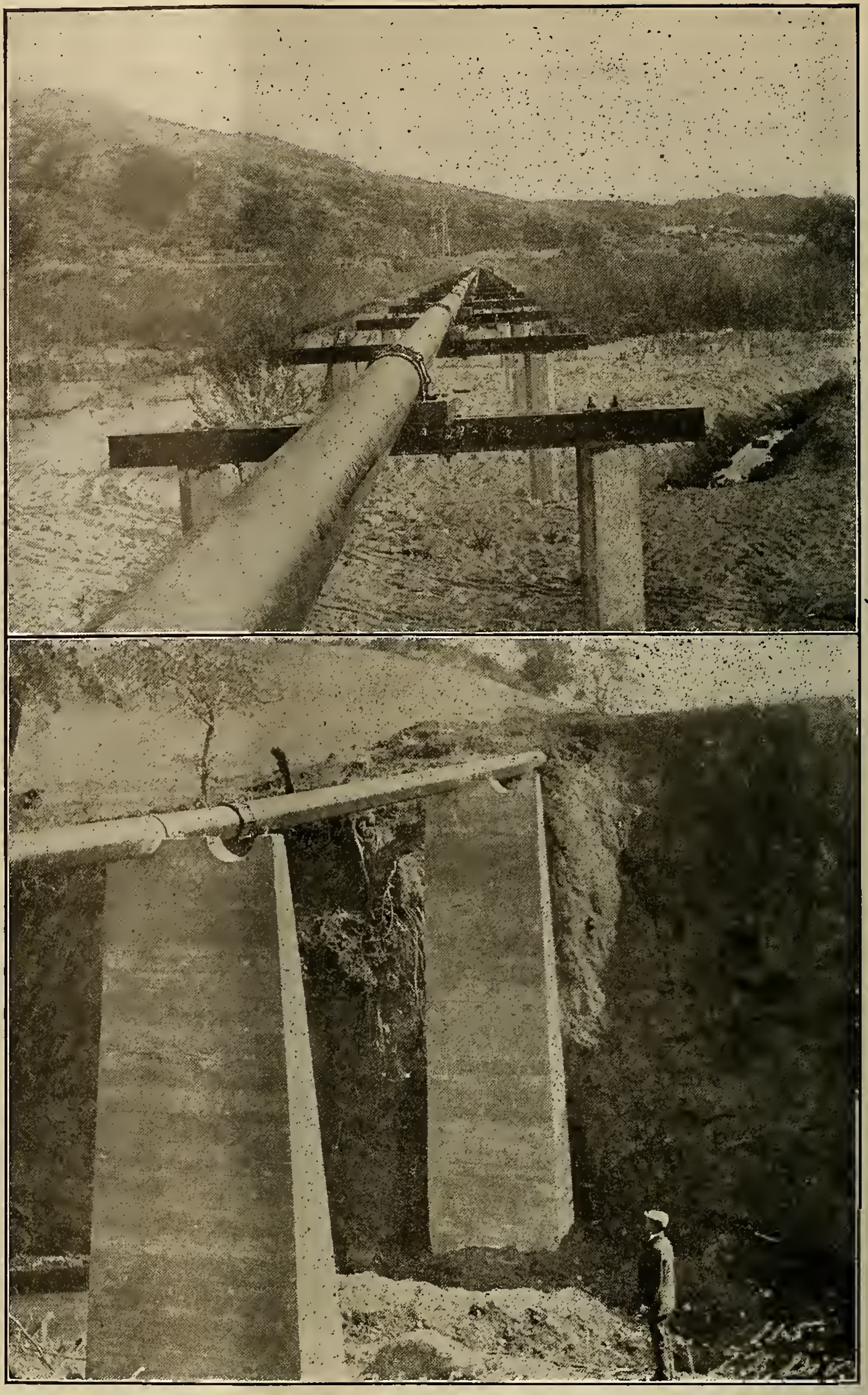
Imagine a line of pipe 12¾ in. in diameter and 112 miles in length, designed to operate under a pressure of 450 lb. and laid to guard against any possible damage which might interfere with the steady flow of the vapor through it, strung across the hot, level plains and winding and twisting its way through and over the mountains, here and there bridging a stream or a gully, and the magnitude of the task is appreciated. At times when automobile trucks and wagons could not travel the steep mountain grades, as many as 1200 head of stock were used to transport the supplies; water for the men and stock was hauled from 18 to 25 miles and at times the camps were 80 miles distant from the nearest railroad station and from 30 to 50 miles from the nearest habitation; 43 miles of road was built through the mountains and in 157 days elapsed time the line was completed and in perfect working order.

The original agreements for the building of the line were entered into on November 26, 1911, and one of the conditions was that the construction work should be completed and the line ready for service within ten months after that date. Before any actual construction work could be begun, how-

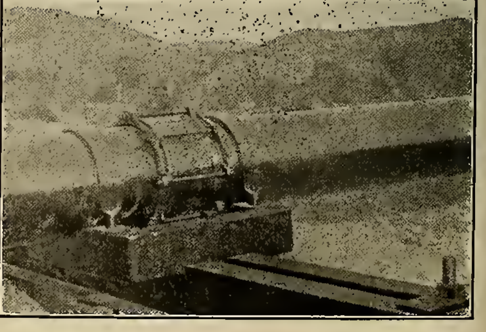
ever, it was necessary to prospect a route. This meant several weeks of very hard work in the mountain section, as any number of possible routes presented themselves and any one of them might appear to be feasible and practical until surveyed, when obstacles might be met with, which when carefully considered, would condemn the possible route. It was in January, 1912, that the preliminary and general survey of the most feasible and economical route was completed, and in the same month orders were placed for 120 miles of 12¾-in O. D. pipe, weighing 33 lb. per foot, which, for two-thirds of the distance, was composed of the double length, plain end tubing, measuring from 30 to 44 ft. in length, together with most of the detail specials.

The first carload of pipe was received and ground was broken on April 19, 1912, at the Los Angeles end of the line. The work was laid out in three divisions. Division No. 1 was at the southern end and began at the Los Angeles terminal, extending to the beginning of the mountain division on the southern slope of the Coast Range. The second division was at the north end of the line in the Midway field and extended in a southerly direction from the wells in the Buena Vista hills to the beginning of the mountain division on the north side of the range. The third, or middle, division comprised the mountain section of the route and this was the principal portion of the line. Before a length of pipe could be laid in this section it was necessary to build 43 miles of road over the rough and steep mountain sides in order to provide a way for the hauling of supplies to establish camps and land materials.

The work on the first and second divisions went along rapidly. At the Midway end the first carload of pipe was received May 1 and as the line went to the mountains by the shortest possible route, good time was made in trenching and laying the pipe over the flat plains.



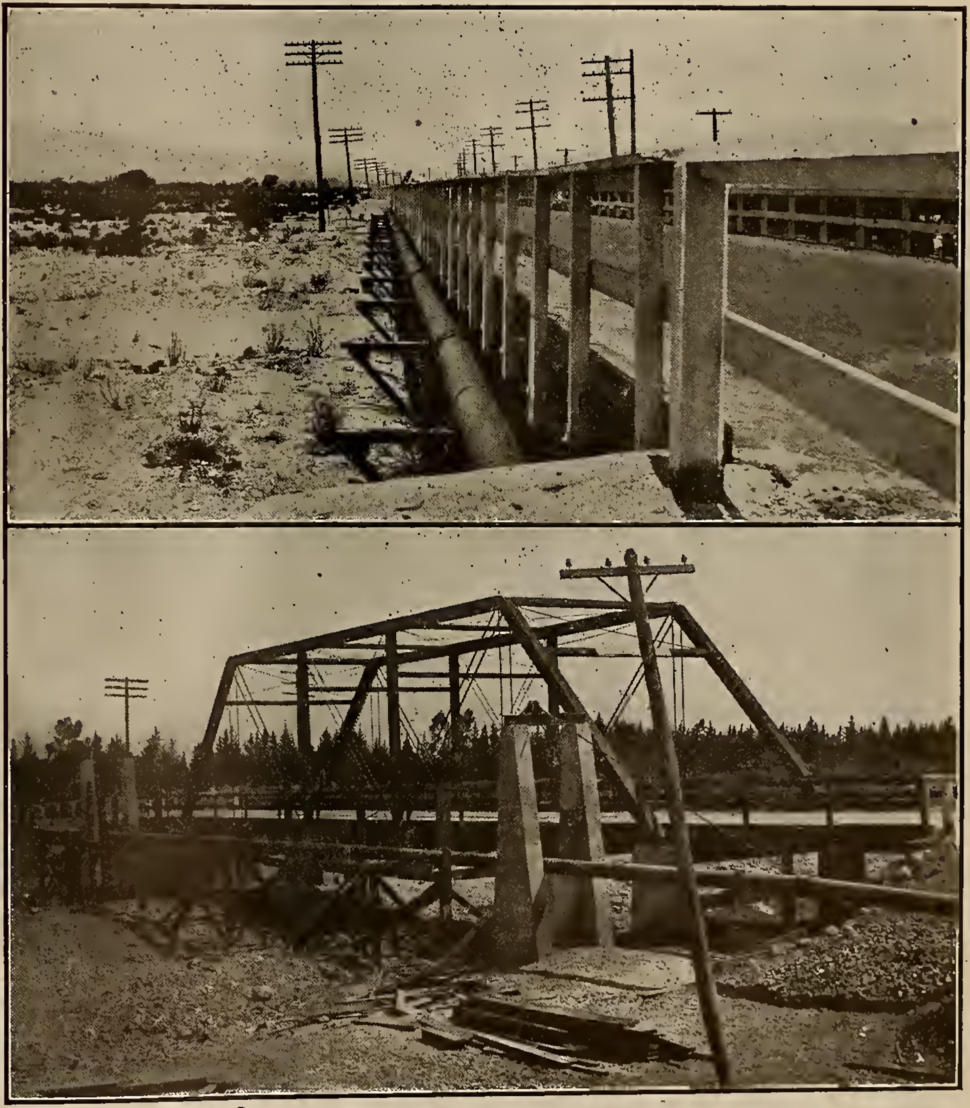
Two Methods of Construction Over Washes—Upper View Shows Castac Trestle on the Los Angeles Division Built of Concrete Piles and Steel Bents. Lower View Is Structure Over Creek at Atmore Showing Provision Made for 16-Inch Line to Be Laid Alongside Present 12-Inch Line.



Cast Saddle Rest at Trestle Bents, Showing Method of Coupling Line to Reinforced Concrete Pile Bridges Constructed Across Streams and Washes.

But in the middle division the undertaking was entirely different. The territory had to be pioneered and brush had to be cut in order to establish camps. A water supply had to be provided in a country where water is a very scarce article. Two good springs were located and 18 miles of water line was laid to these sources of supply. In addition it was necessary to haul water to the pioneer camps, which were 22 and 30 miles still further distant. The hauling was first done by a "go-devil," or a two-wheeled jump cart, drawn by mules chosen because of their sure-footedness over the mountain grades. As fast as the pipe line road was built the "go-devils" were supplanted by 500-gallon tank-wagons drawn by from six to eight head of stock. The water cost 12½ cents per barrel for its purchase and with the additional item of transportation it was a very expensive, although absolutely essential part of the equipment.

The Two-Muled "Go-Devil" on the Left for the Transportation of Water, and the Private Telephone Line on the Right Talking Over the Barbed Wire of a Rancher's Fence.

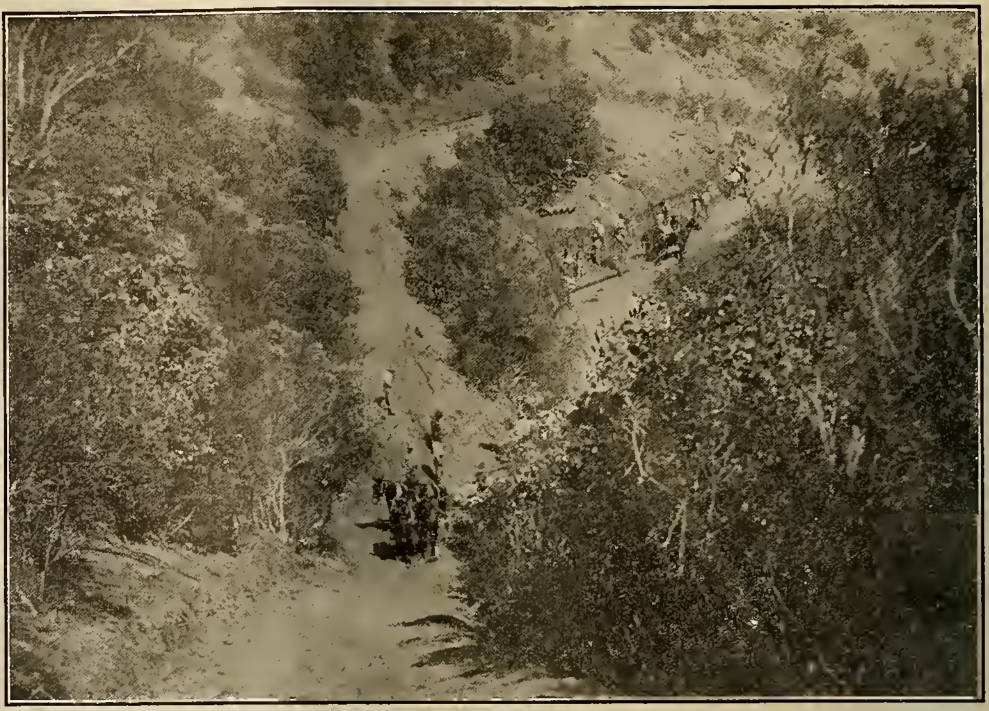


Upper View Shows Pipe Crossing on Hangers at County Bridge No. 1 on the San Fernando Road on the Los Angeles Division. The Lower View Shows the Concrete Suspension Bridge Crossing the Pacoima Wash on the Same Road.

The labor problem was one of the most serious to be contended with, as the conditions under which the men were compelled to work were extremely bad. In the middle division it was necessary to haul the men 57 miles from the nearest railroad station to the first camp. The difficulties may be realized to a certain extent when it is known that the payroll showed in excess of 11,700 different names in five months time in order to keep a gang of about 700 men working on the three divisions. In numerous instances men were hauled to the first camp of the middle division and after getting a view of the country in which they were forced to work, a sample of the heat and the inconveniences of the camp life, they would stay just long enough for one meal and then walk the 80 miles back to the nearest town. They preferred this hardship to working in the middle division of the construction.

The hauling of materials and supplies was also a problem. In the north and south divisions, where the

country was comparatively flat and the double lengths of pipe used, most of the hauling was carried on by motor trucks with special trailers designed for the work. Where the roads were passable, a five-ton truck and trailer could be loaded with from 20,000 to 23,000 pounds. In sections where the roads were rough these loads were obliged to be reduced to 10,000 to 12,000 pounds. When the work reached the mountain district, where the line passes over an elevation at its highest point of 4500 ft., it was necessary to abandon the trucks and conduct the transportation with stock. This service was maintained in full operation with 1200 head, which covered all the line construction as well as maintaining the supplies in the camp.



Pulling Pipe Into Place by Means of Four-Mule Teams in the Mountain District Over Especially Constructed Road.

The question of the commissary was a very important matter as the line was constructed through a section of the country 30 to 50 miles to the nearest habitation. On the north end of the line at the end of the San Joaquin valley, there were weeks at a time when the temperature ranged from 115 to 130 degrees in the shade of a tent, and the water supply, which had to be hauled from 18 to 25 miles, was so strongly alkaline that it was necessary to ship into each camp of 100 men, five cases of lemons and one ton of ice per day, the lemons for the purpose of neutralizing the water and the ice for maintaining the commissary supplies.

Thirty Per Cent Curve on the Main Highway Near Newhall Oil Fields.

Seventeen camps were in operation, distributed along the three divisions of the line. Each division was provided with a hospital tent with a doctor in charge for all emergency cases, and all of the hospital work was under the supervision of a general surgeon, who also had charge of sanitation. This section of the country is void of vegetation, except cactus and sage brush, but there is a generous supply of rattlesnakes, trap-door spiders, centipedes, tarantulas and other inhabitants of the desert which, by the way, did not increase the peace of mind and comfort of the men on the job.

A number of special construction features were developed in the work, among which is a suspension bridge with concrete piers spanning the San Fernando wash. In other cases it was necessary to construct reinforced concrete pile bridges to carry the line over the Santa Clara river and the San Francisquito wash. These bridges required 70 bents. It was not considered practicable to place the line beneath any of these streams on account of the extremely bad bottom, which during the rainy season, is one entire movable mass of quick sand varying in depth from six to fifteen feet. The piles are of the bell-bottom type, and jetted to a solid foundation, vary from 22 to 35 ft. in

length. The piles are capped with eight-inch "I" beams and the coupler rests in a heavy case steel saddle, bolted and strapped to the "I" beam, allowing sufficient space, however, in the event of a leak, for the application of a bowl clamp.

The Big 12-Inch Gas Line as It Was Laid for Miles and Miles Across the Desert in the Southern Part of Kern County.

Patrol stations are located every 10 or 12 miles apart along the route of the line and each is provided with the proper gauges for recording pressure, a supply of repair materials and a private telephone line connecting with the main office at each end of the line and each of the patrol stations. The patrolmen live with their families in cottages built by the company. Under ordinary conditions the patrolmen make one-half of their district in the morning, meeting the patrolman from the next station at their terminal point, and the opposite half of the district in the afternoon. The telephone line is provided with emergency jacks at every mile, and each patrolman carries a portable telephone set so that in the event of trouble, he would not at any time be more than half of a mile from telephone communication.

When the work was tested out it developed one bad length of pipe, weld opened at 368 pounds, and three faulty couplings. The line was designed to stand a pressure of 450 pounds. When these repairs were completed and a test was made from end to end at 170 pounds, the line proved bottle tight and without a leak in the entire 112 miles. The pressure remained on the line for five hours without any drop in the gauges.

The designing, engineering and construction of the entire work was under the engineering and construction department of the J. G. White Engineering Corporation of New York, and directly under the supervision of resident engineer W. E. Barrett, superintendent of construction H. M. Dougherty and assistant superintendents Robert Brisbane, Frederick Weber and Ralph Cormack.

LOS ANGELES' TRANSPORTATION PROBLEMS.

BY CHARLES K. MOHLER.

[The following analysis of the obstacles to rapid transportation is the gist of an address recently given before the City Club, by the author, who is chief engineer of the railway department of the Board of Public Utilities at Los Angeles.—Editor.]

Los Angeles has not one, but many, transportation problems. Here we have both the natural and artificial obstacles thrown in the way of free communication to a marked degree. The larger portion of the present city area is of the rugged hill-and-valley configuration. That means for part of the city more or less thinly inhabited areas, long lines with little or no cross communication for long distances. Other portions are wholly free from these natural limitations.

The business section has developed in a north and south direction mainly along an axis of four streets, Main, Spring, Broadway and Hill. By drawing an east and west line through the north end of the business district say at the intersection of Main and Temple streets, the area of the city is almost equally divided, (excluding the shoestring strip and the harbor cities). The west side of the business district is hemmed in by the natural barrier of a hill for nearly a mile. This barrier turns eastward at the north end and brings three of the business streets, Hill, Broadway and Spring, to a termination as normal traffic outlets. By "normal traffic outlets" is meant one used for both vehicle and car traffic, and without abnormal grades or tunnels.

Tunnels are abnormal for a number of reasons, among which may be mentioned: They are expensive, they afford no place for business or residences along the roadway for that distance; they are damp, poorly ventilated and ill-smelling, almost without exception, they are almost always gloomy and uninviting, if not actually forbidding; they may be termed the last excuse for city communication.

At this point let us glance at the accompanying map. The hill sections of the city are roughly sketched a light shade. Steam railroad lines and some of the area occupied by them, are shown in a dark shade. The area shown in heavy black cross lines is low even ground occupied by manufacturing and industrials, and without any normal through streets in any direction. It is practically a closed section. The open section devoted largely to commercial purposes is roughly shown in black.

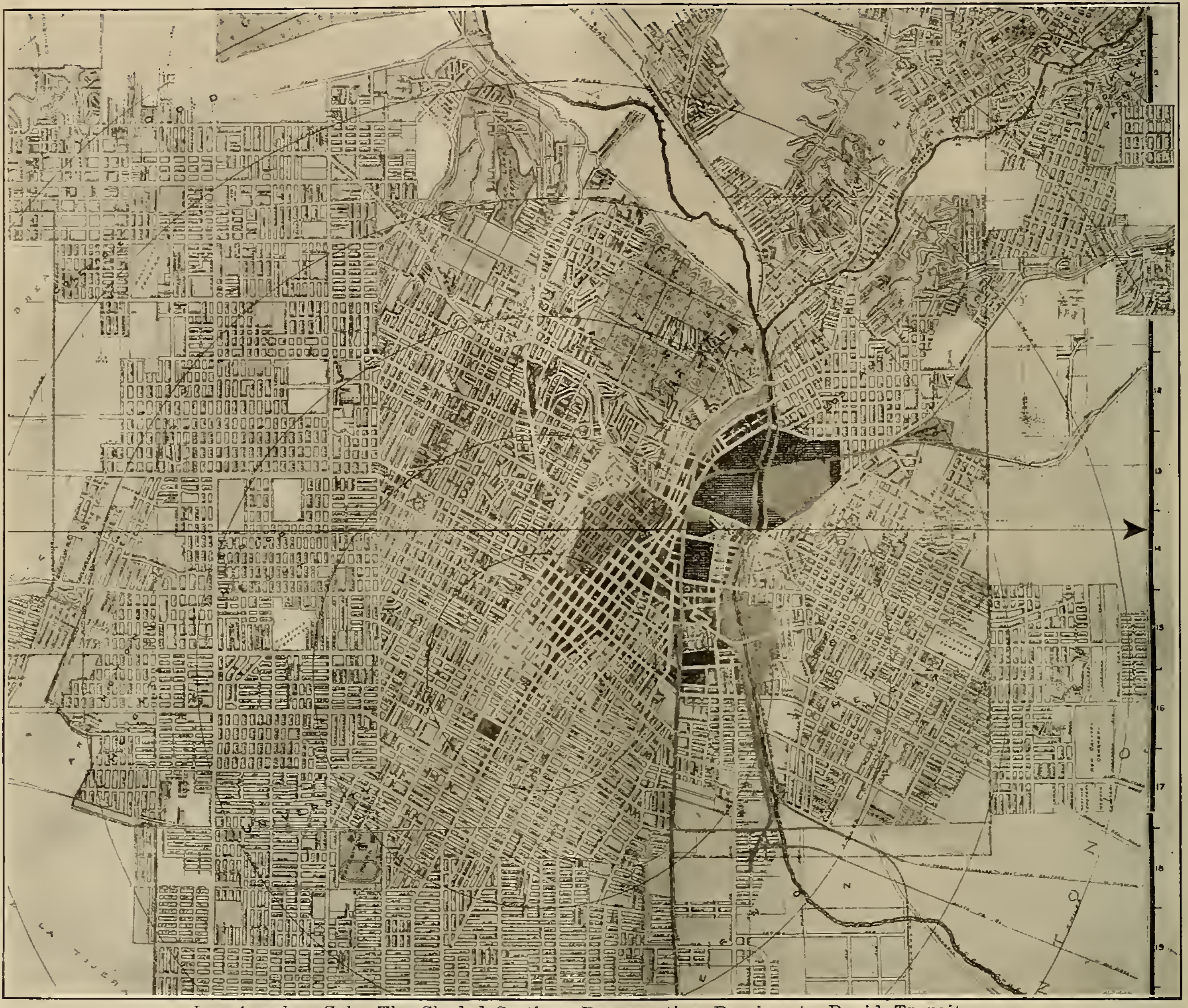
At the south end of the business district between Ninth and Eleventh streets, three of the main business streets, Main, Spring and Broadway, merge into one. This one outlet is only one hundred feet wide, and Hill street ends a little farther out.

The first normal outlet to the west is Seventh street, which fortunately is wider than the other east and west streets through the business section. Yet, it is still an interrupted and otherwise not a normal street. It ends on the west at Catalina street, and has a bad grade west of Boyle avenue. Sixth street, while running through, has a jog and steep grades a short

distance west of the business district, and ends at the river on the east.

To the east there are no abnormal obstructions, but most of the streets are narrow, crooked, and broken by off-sets. North of First street there are no east and west streets crossing Main street without off-sets.

between Macy and Aliso streets, and is directly opposite the artificial barrier and at the dividing line previously referred to, passing through Main at Temple. The artificial barriers which are responsible for this condition are the apparent indiscriminate location of the railroads and industries in this and adjacent districts.



Los Angeles, Cal. The Shaded Sections Representing Barriers to Rapid Transit.

Streets Interrupted or Closed by Artificial Barriers.

In addition to the natural barriers and the bad street system there exist artificial barriers of far greater importance if anything, than those just mentioned. I refer to the absolute closing of the entire river valley, the flat land, from Main street east to Workman street, for nearly a mile and a half, to through north and south communication. This same section is effectually closed to through east and west communication from Macy street to North Main street at the river crossing, a distance of fully a mile. In a number of cases communication in this district is had only through private roadways.

The condition within the area bounded by Macy, Aliso and Main streets, and the river, is almost equally as bad. Remember that the natural barrier of the hill comes down almost to Main street from the west

Characteristics of the Local Car Lines.

If you want some bywords for the situation in which Los Angeles finds itself today, they can be supplied. The features of the local transportation system (the yellow cars) are that: "In the southern end of the business section there is a car line on every street. In the northern end every car line is on one street." Or, if you please, it is a good exemplication of "the hour glass and its workings." The restricted portion is at the center. There is one small opening through which traffic can filter a grain at a time. The sand at the top represents the rush-hour crowd to get in in the morning or out in the evening. There may be this difference however, that the rate of speed is possibly in favor of the hour glass. As a matter of fact there is not a single normal street outlet from the business section to the north, northeast and northwest.

North Broadway makes a roundabout detour and is reached by turning off from Main street or passing through a tunnel; northbound vehicle traffic on North Main street has to cross the main line of the Southern Pacific railroad three times at grade, while the southbound crosses twice, and is crowded over to a narrow roadway to share space with a single track car line on which northbound cars run "against traffic." A little over half a mile further out the Atchison, Topeka and Santa Fe Railway is crossed at grade west of the river, and the San Pedro, Los Angeles and Salt Lake Railroad east of the river. In addition to that, the Southern Pacific Railroad through trains make two movements over the portion of the line on Alameda street.

The situation is certainly a serious one already, and is bound to become much more so as time goes on. In fact, if an effective remedy is not applied, the conditions now existing may prove disastrous to the city's development.

Some Suggested Remedies.

While an exhaustive and detailed study has not been made, from such attention as has been given the question, the following suggestions may be offered as some of the means that may well be employed to remedy and improve conditions.

First: That the railroad terminal situation be taken up and given thorough and comprehensive study with a view to the re-arranging and re-location of main lines where necessary. That all useless and duplicated spur tracks and sidings be eliminated. That the city take an active and aggressive part in the plans of railroad terminals and their ownership. That the three interstate roads, the Atchison, Topeka and Santa Fe, the Southern Pacific, and the San Pedro, Los Angeles and Salt Lake Railroads, all be brought together in a Union Station. It is believed the rearrangement would best be about as follows:

Use the site of the present Arcade Station for the Union Station, bring the Santa Fe and Salt Lake roads in over elevated tracks of the Southern Pacific Railroad from the junction of the connecting line about Alameda and Twentieth street to the Union Station say on Central avenue, between Fourth and Sixth streets.

From Fourth and Alameda streets build an elevated connection to meet the Santa Fe line at about First street. This portion to be built and owned jointly by all lines. From about First street and Santa Fe avenue, the Southern Pacific Railroad, bound to and from San Francisco, to use the Santa Fe line to about the crossing of North Broadway.

There is already a connection between the "Salt Lake" and the Southern Pacific at Alhambra street, just east of the river in the southeast angle. Another connection in the north east angle would allow a north and east movement without passing over to the west side of the industrial district. A bridge over the Los Angeles River should be constructed some place between Second and Alhambra streets so as to carry the Salt Lake route back to its own lines, and form a route for the Southern Pacific trains to and from the east. A short connection east of the main river from the Salt Lake at Barranca street (just beyond the Santa Fe) to the Southern Pacific just north of the river crossing, made mostly along the river bed owned by the city, would complete the route. That rearrangement would leave the district west of the river practically free of main line tracks from First street to North Broadway.

The Pacific Electric Railway might be brought in on an elevated structure alongside the steam roads from Aliso street to the Union Station. These same lines from the south might be brought in over Central avenue, or alongside the steam road elevated structure to the Union Station.

Second: The main line tracks of the Southern Pacific should be removed from Alameda street from Fourth street to about Alpine street. Central avenue should be widened north of Second street and carried diagonally into Alameda street in the vicinity of Market street.

Third: All of the main line tracks and crossings of the Southern Pacific should be removed from North Main street.

Fourth: Santa Fe avenue might be very well continued north along the railroad right of way or as nearly so as advisable, to about San Fernando street.

Fifth: The main tracks of the Southern Pacific should be removed from Alhambra west of the river, and this street opened up as a thoroughfare. In addition, suitably improved roadways should be provided on Alhambra street, outside of the Southern Pacific tracks east from the river to the intersection of Mission Road.

Sixth: Mission Road should be properly improved and a suitable connection provided for reaching it other than by Macy street alone.

Seventh: Sixth street might to good advantage be cut through from where it now stops at the Santa Fe tracks, to a junction with Boyle avenue at the angle and depression opposite Hollenbeck Park. That would give a direct low grade line to reach Stephenson, Boyle and Chicago avenues.

Eighth: Los Angeles street should be widened and straightened where necessary, and supplied with tracks to relieve the over congested tracks on Main, Spring and Broadway.

Ninth: An adequate number of both north and south and east and west streets should be opened through the "closed" section between the river, Macy, and North Main streets.

I understand a Union Station for Los Angeles has been advocated for a long time, and that several years ago considerable effort was made to secure one. I do not believe it should be given up, even if you have to keep on fighting for it. There are many reasons to be given in favor of a Union Station in Los Angeles, and few, if any, against it, aside from the old selfish interest and jealousy of the individual roads concerned. There are twenty-three different systems entering Chicago, and all are taken care of by six different stations. The largest number accommodated at any one station is seven. One station ought to take care of the three roads here.

The conditions in Los Angeles are peculiarly favorable for a Union Station. The railroads bring

very little local or commutor travel into the city (that being handled by the electric lines). While the aggregate travel is large, it is mostly seasonal and distributed in either direction over a period of several months. The city being so far removed from large centers of population, convention and exposition crowds are not exceptionally large or frequent.

The local city transportation system, not to mention the interurban lines can be arranged to give much better service to a union station than it can to serve a number of scattered and unrelated stations, and is of greater importance than generally appreciated.

The location at Alameda, between Fourth and Sixth streets is just off from Seventh street, which is a wide street and the first to pass through the business district to the west without serious obstacles. On account of general traffic conditions, it is perhaps better to have a depot a little off from a main axis thoroughfare rather than directly on it. If Sixth street were opened across the river to connect to Boyle avenue, as previously mentioned, the East side would be made more directly accessible to the station. A union station at the designated location should tend to encourage the development of a stronger business axis in an east and west direction. This is a very important point to consider in planning to get relief from the tendency to over-crowding and congestion.

The site for a union station might be located even farther south to advantage.

Existing bad conditions should not be allowed to become crystallized and fixed by the different railroads building independent and unrelated terminals which may be still further complicated by the probable requirement of grade crossing elimination.

Relief by "Subways."

There is a popular impression that subways are the ultimate if not the ideal, remedy for evils our neglect and lack of fore-thought have brought upon us. Can we not, no, must we not, plan and build our cities so that we are not compelled to resort in any great degree to this method of providing for communication.

The time usually taken to decide upon and actually construct subways and their great cost is really discouraging. How many of us realize that subways cost from 50 to 100 times as much as the same amount of trackage on the surface. One mile of double track subway in Washington street, Boston, cost considerably over $5,000,000. A mile of single track surface line in a paved street will cost from $30,000 to $50,000 while one mile of single track in subways can be expected to cost not much less than $2,000,000.

In other words for the cost of one mile of subway you can build about sixty to seventy miles of ordinary surface track. Take another comparison if you please. For the cost of the 230 miles of aqueduct just completed, you could build on the basis of the Boston cost above referred to, about 6 miles of single track.

The one mile of the Washington street double track subway in Boston cost one-third as much as the entire value of the local car system complete with equipment and all. On the other hand the cost of the aqueduct would build and equip 350 miles or more of single track surface line.

The best of creation does not burrow or live underground. Would it not be the better part of wisdom to make the necessary changes and re-adjustments of the surface conditions that are available and not driven to the enormous expense of constructing undesirable subways.

If subways are the only remedy, some method of financing should be employed other than burdening the local transportation system with their cost.

Objectionable Industries.

In the general clean-up and re-arrangement to open up the closed districts we have been considering, attention should be given to some of the more objectionable industries now located in this section. Among these may be mentioned the oil refineries, gas works, slaughter houses, brick yards, etc. These objectionable industries should be further removed and isolated from what of necessity must be the city's main gateway at the north end of the business district to the north.

Conclusion.

While all cities have their transportation and other problems, I do not know of any that are potentially as bad as that of Los Angeles, where this natural gateway to the north has been allowed to become practically closed. In addition, a large portion of the entire street system of the city is fundamentally bad from the standpoint of normal communication and traffic needs. As a village it would make little difference. It is a serious problem as it exists today. For the future it is a menace.

There are many other items unrelated to the present discussion that should receive consideration and study.

You may ask, "Is all this really worth while?" In my estimation the whole scheme outlined embodies changes and improvements of almost, if not altogether, imperative needs.

Is it not quite time that the city take an active and aggressive part in its development as far as the vital needs of transportation and intercommunication are concerned?

A realization of our difficulties should give us the determination to go ahead and make the necessary changes to accomplish the desired results. Things that are really worth while are rarely had without considerable effort.

Ozone is a powerful deodorizer, masking rather than destroying smells. Its beneficial effect on the human system is due to its action on the nervous system. By exciting the olfactory nerves and those of the respiratory tract and skin it may relieve the monotony of close air. By irritating the respiratory tract it also brings more blood and tissue lymph to the surface, thus giving a simple and convenient method of applying a "blister" to the respiratory tract. Exposure for two hours to a concentration of 15 to 20 parts per million is dangerous.

ELECTRICAL PUMPING AND IRRIGATION

TYPES OF PIPE IRRIGATION SYSTEMS.

BY B. A. ETCHEVERRY.

Pipe systems may be classified as high pressure systems and low pressure systems. There are no sharp distinguishing factors and one type may merge into the other.

High pressure systems are used when the land is steep and irregular, producing high pressures on the pipes. One form of such a system consists either of a high line main canal or main pipe located along the upper part of the land to be irrigated, and from which the pipe laterals take out to supply sublaterals or to directly supply the farms or orchards in the valley below. Another form consists of a main pressure pipe line placed in the trough of the valley and branches extending up the sides of the valley along the ridges, if possible, to supply smaller laterals or the farms or orchards. The branches or laterals are generally under considerable pressure and are usually wood banded pipe and in some cases steel or iron pipes. The main laterals are tapped by smaller pipes which either deliver the water at a measuring box through a valve takeout or which are connected directly to the private pipes; this has the advantage that it maintains the pressure at which the water is delivered but it makes the measurement of water difficult unless regular domestic supply meters be used. When a main pressure pipe placed along the trough of the valley is used, the entire system consists of pipe lines under pressure, and the system is similar to a domestic supply system and a few such systems in the Northwest combine the irrigation system with the domestic system. Such a combination has the advantage that the system is kept continuously full during the entire year, which increases the life of a wooden pipe system. It requires, however, that the pipe lines be protected against freezing by being buried deeply in the ground or by an air tight boxing of sawdust where it is built above ground. It is not always possible to combine the two, for often the source of supply may be so polluted that it must be filtered or treated to purify it and it would be poor economy to have to purify the irrigation water as well as the domestic water. High pressure systems of the above description have been constructed for some of the orchard lands of Washington, Idaho, British Columbia and Southern California. The design of the system is similar to those for domestic supply and for that reason has not been discussed in detail.

Low pressure systems are used when the country does not form deep depressions which would cause high pressures on the pipe lines. Such systems, however, are not limited to flat lands or lands with flat grades but are well adapted to steep land with uniform grades, where it is possible to locate the pipe lines and regulate the flow in them so that the pipes are not depressed much below the hydraulic grade lines and a low pressure is maintained. Such a system consists of the main canal or main pipe lines surrounding the irrigable area, from which the smaller pipe lines or branches take out. They in turn may be divided into sub-branches. All the pipe lines terminate in an open end which discharges into a waste channel or waste pipe. The open or free lower end with the pressure regulating boxes along the pipe lines prevent the possibility of high pressures. The main difference between a high pressure system and a low pressure system is that in the first the pipes are continuously under moderately high pressures, the system being similar or identical to a domestic water supply system, while in the second the pressures are kept low and the flow in the pipes is more that of gravity flow similar to that in canals. The low pressure system is used almost entirely in Southern California and its use is being adopted in other states. Cement pipes are generally used, although in some cases vitrified sewer pipe has been used.

Parts of a Low Pressure Pipe System.

A typical cement pipe system consists of: (1) main open canal, (2) pipe laterals and sub-laterals, (3) waste pipes, (4) regulating pressure boxes, division or takeout boxes, measuring boxes, (5) air stands, (6) blow offs.

The main canal is usually a concrete lined canal and the pipe lateral headgates are formed much in the same way as described for open canal laterals. A pipe headgate consists of a pipe placed in the bank of the main canal, regulated at the upstream end by a gate and connected at the downstream end to a measuring box. On some systems the main canal has been replaced by a concrete pipe and the takeouts from the pipe constructed as those from pipe laterals.

Pipe laterals and sub-laterals.—Cement pipes will not stand high pressures. They are used more as a substitute for open canals where the topography is such that open canals would require a large amount of heavy fills or flumes. It is generally possible to locate these laterals so as to keep the pressure not in excess of the maximum pressure which cement pipe will stand. When there are ridges, the main pipe laterals are located on the main ridges and the sub-laterals are located on the smaller ridges; all pipes should terminate in a waste channel. When depressions have to be crossed which give higher pressures than the pipe will stand, some other kind of pipe must be used. When the slope of the country is a uniform slope the pipe line must be divided into sections by means of pressure regulating boxes whose purpose is to raise the hydraulic grade line and to divide the pipe lines into short enough sections to prevent high pressures. These boxes correspond to the check gates on open canals. They check the flow of water and force the water to rise through the private takeouts or branches above them. In locating these boxes and the takeouts the hydraulic grade lines must be consid-

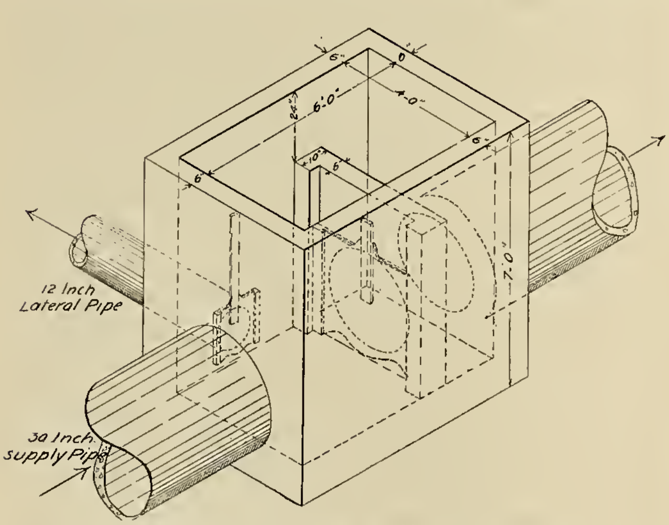
ered carefully, not only for full supply but also for partial supply.

Waste pipes are the extensions from the ends of the distributing pipe lines to a waste channel or drainage channel. Their purpose is to carry the waste or unused water and they must be made of ample capacity.

A pressure regulating box consists of a rectangular box connected at the bottom with the cement pipe. Between the inlet and outlet to the box is built a spillway or overflow wall with its crest at the level to which it is desired to raise the water surface. At the bottom of the overflow wall is an opening of the size of the pipe regulated by a gate. The water rises in the upstream part of the box and passes over the overflow wall back into the pipe. The box is similar in design to the turnout boxes and measuring boxes described further.

A division box is formed of a regulating pressure box, the connection with the branch or branches being made in the upstream compartment of the box. An example of this type of box is the Covina Irrigation Company pipe turnout described farther.

A measuring box is used at the point of delivery to the irrigator and in some cases at the junction of two lines. The measuring box can be built in combination with the takeout or may be built separately and the water carried to it by a pipe connected by means of a division box to the supply pipe. The first is usually preferable and more economical. The measuring box may be formed in two ways according to



Pipe Turnout of Covina Irrigation Company.

whether it is connected to a pipe with gravity flow regulated by pressure boxes or to a pipe under pressure. A good example of the first type is the combined turnout and measuring box of the Azusa Irrigation Company, described further. The second type is made by cutting a hole in the top of the supply pipe above which a valve is cemented in and a measuring weir box or miners' inch box built around the valve. A description of this type of weir box and takeout has already been given.

Air stands are necessary at all summits and at convex bends when the pipe approaches the hydraulic grade line. At the summits there are usually regulating pressure boxes which will serve as air vents. Air stands are made of cement pipe cemented vertically around a hole cut in the supply pipe.

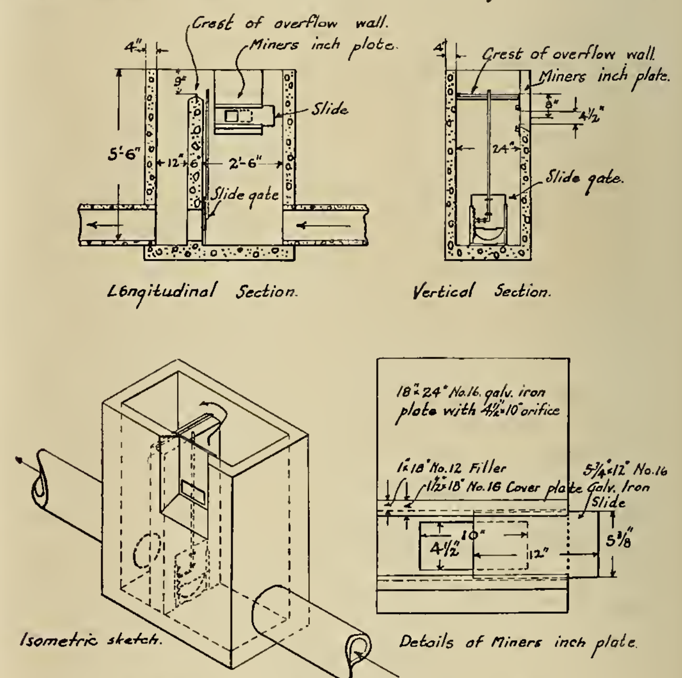
Blow offs are necessary at the lowest points to empty the pipe.

Covina Irrigation Company, Pipe Turnout.

This is a rectangular concrete box in which the supply pipe enters at one end and leads off at the other. Between the inlet and outlet is an overflow wall which divides the box into two parts. The branch line is connected to the inlet part of the box. The flow is divided between the two lines by means of an opening at the bottom of the overflow wall, regulated with a slide gate and by another gate at the entrance of the branch line. If the opening in the overflow wall is closed all the water can be forced into the branch. If both gates are shut the water passes over the overflow into the outlet part of the box and goes on in the main pipe.

Miners' Inch Box and Takeout from Pipe Line Under no Pressure.

Where a pipe line is under no pressure the conditions of flow are similar to those in an open ditch. The pipe line is placed on grade and to take out water from it, it is necessary to form a takeout box by means of which the water is checked and forced to rise to the height at which it is delivered to the irrigator. This is somewhat similar to the check gates which are placed across an open canal where it is necessary to raise the water level to make a delivery into the head



Typical Miners' Inch Box for Takeout from Gravity Pipe Line Under No Pressure.

of the irrigator's flume or ditch. For a pipe line the takeout and measuring device can be formed in one structure as shown in accompanying drawings. The box used on the Fruitlands irrigation system near Kamloops, British Columbia, is similar to the boxes used on many irrigation systems of Southern California, of which the turnout and measuring box of the Azusa Irrigation Company, is an example. The box is rectangular and is divided into two compartments by an overflow wall at the bottom of which

there is an opening, controlled by a slide gate. In one of the side walls of the upstream compartment a miners' inch plate is placed with the center of the orifice 8 in. below the crest of the overflow wall. The walls are all reinforced with strands of barb wire. The water enters the upstream compartment and by means of the gate in the overflow wall can be made to rise level with the overflow crest and the quantity delivered is regulated by adjusting the orifice. The pressure on the orifice is regulated and kept more or less constant by the overflow wall. The excess water passes over the overflow wall and also

Takeout and Measuring Box of Azusa Irrigation Co.

through the regulating gate into the downstream compartment and from there into the pipe. By proper adjustment of the gate the water level may be kept fairly constant. When the gate is entirely closed the excess water will pass over the overflow and increase the pressure on the orifice and the accuracy of the measurement will depend on the quantity of water passing over and the length of the overflow crest. A moderate increase in pressure will not affect the accuracy very greatly; for instance a 1 in. increase in pressure will increase the volume delivered by 6 per cent. It would be feasible to use a weir plate in place of the miners' inch plate, but with a weir plate the quantity delivered could not be adjusted and the accuracy would be affected to a much greater extent by an increase in depth of water on the crest.

Takeout and Measuring Box of Azusa Irrigation Company, Southern California.

This box differs from the previous one in that instead of delivering the water through an orifice adjustable in size by a slide, it is delivered through a number of openings varying in size and each closed by a slide gate. The pressure on the center of the opening is 4 in. The water passes through the orifices into a rectangular basin connected at the bottom to the private pipe of the orchardist. Frequently this basin is made of larger sizes of cement pipes split longitudinally in two and cemented to the box.

UTAH TO CONTEST FEDERAL INTERVENTION IN CONTROL OF WATER POWERS.

To settle the question of state control Utah may go into the Federal courts as an intervenor against the national government in suits brought by the government against local power companies to prevent the use of the public domain for right-of-way for the power transmission lines. At a conference in the office of Governor Spry last week, attended by the governor, G. A. Iverson of the attorney-general's office, S. A. Bailey, attorney for the Utah Power & Light Company, L. L. Nunn and others, it was agreed that such action should be taken as a protest against alleged usurpation of state rights.

"Federal interference in these matters is hampering the development of the state's natural resources, and it has come to a point where something must be done in opposition to the attitude of the government," said Governor William Spry after the conference. "It is probable that the state will step in as an intervenor in the suit now pending in the circuit court of appeals against the Utah Power & Light Company, and in other suits that may arise involving the same question. The protest would in reality be a plea in behalf of all the people for more aid and less hindrance on the part of the government in the up-building of the state through the use and development of its natural resources."

With the filing of the petition of intervention, Utah will become the first state to take an actual stand against the public domain policy of the government, not only involving the specific suits now pending, but many other issues such as those pertaining to the rights of homesteaders, mining prospectors and others, will enter into the intervening petition. It will cite the state's absolute ownership of water as cited by the national government and the right of the state to grant to companies or individuals the privilege of developing and using the water power within the state. It will contend that the federal government has no right to abridge or nullify that right by prohibiting the use of the public domain for rights of use for public transmission, and otherwise interfering with the development of the water power.

"It simply amounts to this," said G. A. Iverson of the attorney-general's office: "The state has granted to these companies the right to develop water power, and because of the attitude of the federal government, is unable to guarantee the enjoyment of these rights."

So far as the individual companies are involved, the state has no concern, but it is the larger question of the welfare of the entire commonwealth that is at issue. For that reason, the action of the state in becoming an intervenor will practically amount to a declaration of state rights.

CO-OPERATIVE PUBLICITY.

BY L. A. OSBORNE.

It may doubtless appear unusual to some that the electrical manufacturers should have so readily agreed to make liberal contributions to the funds of the Society for Electrical Development. In fact the readiness of the manufacturer to support the movement has led some to suspect that it was planned primarily in the interests of the manufacturer. Reflection, however, will show that the attitude of the manufacturer is merely co-operative in the broadest sense of the word and is an evidence of his appreciation that that which is truly co-operative is, in the last analysis, profitable. Speaking as a manufacturer, we expect that our return will accrue after the central station, jobbers, dealers and contractors have begun to enjoy a measure of return as a result of the activities of the Society.

It goes without saying that the success of the movement will largely depend upon the spontaneity with which the different branches of the industry respond. There is a psychological moment when a movement of this character should be launched, and that is that moment when all are of the same mind as to its importance. Let that moment pass without definite action, and there is a danger of a weakening of that sustaining power of co-operation which is needed. If the different branches of the industry are willing in spirit, but lacking in financial help, those entrusted with the responsibility of making the work of the Society successful will not be encouraged to proceed with the confidence and enthusiasm which is so necessary in an undertaking of this kind; neither should they be handicapped by the necessity of seeking members, but should be permitted to exercise their talents in the legitimate activities of the Society which is broadly to impress upon the public at large the desirability of "Doing It Electrically."

The ideals of the Society are ambitious but attainable, and when carried out should, within a reasonable time, bring measurable returns to all branches of the industry.

The advertising planned by the Society to awaken an interest in things electrical should very early have an appreciable effect upon the trade of central stations, jobbers, dealers and contractors.

If, through such co-operative advertising, the architect, the contractor and the builder might be educated to the point that in all dwellings, regardless of cost, outlets for the use of electrical appliances should be plentifully provided, the business of the dealer in electrical appliances would be increased, as well as the work of the electrical contractor, and it goes without saying that there would be a corresponding increase in demand for current through which the central station would profit. The manufacturer secures his reward through an increased demand for his manufactured products, and, in the broader aspect of the case, in the ultimate increase in generating and distributing apparatus.

The general education of the people in the use of electrical vehicles brings its reward to the manufacturer of the vehicle, as well as to the makers of the motor and battery which propel it, and continuously to the central station providing the current for its operation.

When real estate dealers and investors are educated by co-operative advertising to make capital of electrically lighted and electrically equipped homes, then naturally an increase in business is bound to result therefrom, and as the ideas of men enlarge the volume of increase will multiply rapidly. It is to our interest to educate the public to the feeling that that which yesterday was merely an electrical luxury is today a necessity.

When we can familiarize men in the professions —dentists, surgeons, doctors, etc.—and in the multiplicity of trades, even the smallest and least important, with the value of doing things electrically, to make such men understand about things electrical, great will be the profit to the electrical business, and we will have realized, in part at least, one of the ambitions of the Society.

Especially should this movement appeal to central stations, even more than to the manufacturer, for each customer of the central station is a continuing customer and the source of continued profit and revenue, whereas to the manufacturer each sale is a transaction complete in itself.

Altogether a movement having such useful and beneficial aims should receive the generous support of all in the industry, at least until such time as the soundness of the idea can be tested, and particularly of those branches of the industry which are obviously most likely to receive the most immediate returns from the movement.

GOVERNMENT TO SELL LUMBER AND POLES IN WASHINGTON.

A sale of government timber involving 70,450,000 board feet and 286,000 linear feet of cedar poles on the Olympic national forest, Washington, is to be advertised. The first block is within the watershed of Little River, and is estimated to contain 16,060,000 board feet of Douglas fir, 1,080,000 ft. of red cedar. 2,160,000 ft. of western hemlock, and 100,000 linear feet of cedar poles. The minimum rates which will be accepted for this timber are $1.65 a thousand for Douglas fir, $2 a thousand for red cedar, and 50 cents for western hemlock. The cedar poles will be sold for not less than ¾ cents a linear foot for poles under 45 ft. in length, with not greater than a 10-in. top diameter; 1¼ cents a linear foot for red cedar poles, 45 ft. and over in length, with not greater than a 10-in. top diameter.

On a second block, which is in the watershed of Ennis and Lake creeks, there are estimated to be 31,400,000 board feet of Douglas fir, 5,430,000 ft. of red cedar, 13,400,000 of hemlock, 220,000 of amabilis fir, and 186,000 linear feet of red cedar poles. The prices here are a little higher than on the other block, and the minimum rates at which the timber will be advertised are. Douglas fir, $1.80 a thousand; red cedar, $2.50 a thousand; hemlock and amabilis fir, 50 cents a thousand. The rates for cedar poles are similar to those prescribed for the first block. A period of five years will be allowed for the cutting and removal of the timber, subject to a readjustment in stumpage prices at the discretion of the forester in 1916.

MOTOR DRIVEN IRRIGATION OUTFITS.

At the irrigation plant of the Moulton Irrigated Land Company, near Princeton, Butte County, Cal., a 30-inch Byron-Jackson centrifugal pump driven by a 150 h.p. Westinghouse induction motor has been installed. This unit is designed to deliver 30,000 gallons at a head of 18 ft., but, due to the rise and fall of the river, the working head varies, and when the river is unusually high, the motor is considerably overloaded.

This condition obtained last spring, and for a period of several days the motor operated continuously at about 225 h.p., or 50 per cent overload. In spite of

Irrigation Barge on Sacramento River.

these very severe conditions, the motor kept steadily at work, irrigating about 1500 acres of beans, barley and wheat. If the motor had failed at this particular time, the crop would have been lost.

Power for the motor is derived from the 60,000 volt lines of the Pacific Gas & Electric Company. The voltage is stepped down to 11,000 for transmitting 18 miles, and is then stepped down to 440 for the motor.

The cost for installing the irrigating system has not exceeded $15 an acre, while the value of the land has increased $50 to $75 an acre. The cost of irrigation per acre does not exceed $1.25 including labor.

In order to irrigate its rice lands along the Sacramento River the land company has adopted the somewhat unique plan of installing a motor-driven pump on a barge, which is towed from point to point by a gasoline launch and is thus able to accomplish what would otherwise require four stationary plants.

The barge contains a 20 in. Dow centrifugal pump belted to a 100 h.p. Westinghouse induction motor. Power is obtained at the four pumping points from 11,000 volt lines of the Pacific Gas & Electric Company. A bank of transformers on the barge transform this current to 440 volts for use by the motor.

The pump handles about 16,000 gallons per minute. The head varies from 12 to 23 ft. as the river rises and falls, and the motor is overloaded about 30 per cent when the river is at its highest point, but it has carried this overload for considerable periods of time without distress.

The pump is operated almost continuously from the latter part of April to the latter part of August, being shut down only when the barge is being towed from one point to the next.

LIGHTNING LIFTS NAIL FROM FLOOR.

Lifting a wire nail from the floor and driving it to the head into a board in the ceiling eight feet above is one of the freak stunts of a bolt of lightning, reported from the Davis log hotel at Brighton, near Salt Lake City. The lightning is said to have struck a disconnected telephone wire leading from a pole in the road to the side of the hotel, following the wire through a small hole in a log, splitting off a chunk several feet long, descending to the floor of the kitchen and ripping a hole in the board. A wire nail on the floor is claimed to have been elevated from the floor and driven to the head in the ceiling, the ceiling being punctured by small bullet-like holes in a score of places, and a mattress on a bed directly above the kitchen set afire.

Electroplating of metals is satisfactory in the case of copper, gold, silver, cobalt, nickel, lead, brass and tin, but the present methods for bronze are not practical. For tin the immersion process is cheaper, especially for coating large articles, for electrodeposition is largely used for small articles. Lead plating is dependent upon the use of fluosilicate and the perchlorate bath.

Sterilization of water may be readily accomplished by exposing it to the ultra-violet radiations from a quartz mercury vapor lamp completely immersed in the water. A muddy water must first be filtered, as clear water is practically the only known liquid permeable to the ultra-violet radiation and easily sterilized by it. Experiments show that colon bacilli, typhoid-fever bacilli and fecal matter, and other microbes are thus killed by direct bactericidal action and not indirectly by a chemical modification of the water.

Electric cooking at Shanghai was introduced in the International Settlement less than three years ago by the Electricity Department of the Shanghai Municipal Council, which is supplying the necessary outfits on hire at a small monthly rental of 0.50 tael (about 33 cents United States currency) for either cookers or radiators. During 1912, according to the report of the electrical engineer, the radiators and cookers together connected to the mains represent a load of 293 kilowatts or 77 per cent over 1911, and brings the total connected to the mains up to 674 kilowatts. Heating and cooking outfits of both American and European manufacture are used. The residential rate for electricity for lighting purposes is about 6 cents United States currency per kilowatt hour, and for heating and cooking about 1 2/3 cents per kilowatt hour. Alternating current is supplied at 200 volts, 50 cycles.

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POWER AND GAS

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

High Pressure Gas Transmission

Electric power no longer has a monopoly on the claim for long distance transmission at high pressures, as can be learned from reading the article on the Midway gas line in this issue. A great pipe more than a foot in diameter transmitting natural gas from the Midway oil fields one hundred and twelve miles to the city of Los Angeles is an undertaking of great magnitude. The construction difficulties are fully explained in the article and are typical of many of the other record-breaking feats for which the West is famed.

While sufficient time has not elapsed to prove the commercial features of this venture the experience of other localities would point to its ultimate success. Natural gas has revolutionized the fuel problem in Pittsburg and is everywhere aiding the campaign for smokeless cities. According to present indications the industrial uses will be more important than the domestic consumption in Los Angeles. It has been used instead of oil under the boilers of some of the electric generating plants and as soon as tests have been completed the data will be published. One of the initial difficulties has been the deposition of dust in the station meters and elsewhere and it may yet be necessary to adopt some sprinkling system to remedy this trouble. Such mechanical setbacks, however, should only temporarily retard the success of this commendable effort to conserve a valuable by-product which has hitherto been wasted.

Private Operation Under Municipal Ownership

"Tried and found wanting" applies with equal force to the several methods of supplying communication, light and power to the public which have been employed in the past. This is as true for private ownership and operation as for muncipal ownership and operation. In the governmental laboratories where the chemists are legislators and the product, laws, the new experiment of public regulation of private utilties is now being tried. Though they have not yet produced perfect crystals from which the failure of this experiment can be proved, certain conditions of the reaction are so evident as to enable the analyst to make a forecast which has many elements of probability.

The sulphites, the radical element, think that regulation is not powerful enough to neutralize the abuses which they associate with private ownership and operation. The bromides, the conservative element, fear that regulation will be so extreme as to kill the patient while trying to cure him. Both recognize that, unless some new reagent is introduced, the result will inevitably be governmental ownership and operation. In Germany, for example, the Prussian government is now developing the water powers in the State, the waterways department of the ministry of public works having direct charge of construction, operation, distribution and sale of electric power. In this country the same procedure is proposed with regard to the Cecilio Falls of the Columbia River in Oregon.

Before continuing to such an extreme as will completely discourage private initiative, would it not be wiser to at least make a trial of some new reagent,

such as the private operation of publicly owned utilities? Such a suggestion has frequently been discussed in these columns and as yet no argument has been put forth to disprove the advisability of such a trial.

The Kilowatt Ampere

More confusion has been raised in the average mind by the term "kilovolt-ampere" and its abbreviation, "k.v.a.," than by any of the other mystifying expressions which the electrical salesman so fluently rolls off his tongue. While the layman may be impressed with the profundity of his ignorance of electricity he is not thereby the more readily induced to buy electrical apparatus. Mystery and confidence are never affinities. Furthermore the man who so glibly prates of kilovolt-amperes can seldom intelligently explain why this term has displaced the kilowatt rating of an alternating current generator since the motor load on the machine has become of more importance than the lamp load.

A kilovolt-ampere is a thousand volt-amperes, or units of apparent power. A kilowatt is a thousand watts, or units of actual power. This distinction between apparent and actual power is much the same as that between two steins of beer; one of which has froth on top while the other has not. Though the froth has little real power it takes up a part of the stein's capacity which might otherwise be filled with liquid. The capacity of a generator is limited by the temperature at which it can be operated without burning out. This heating depends upon the number of amperes forced through its coils by the voltage. Consequently the generator's capacity is determined by the maximum current which it can carry safely, rather than by the kilowatts which it can deliver: just as a stein is rated on the amount of froth and liquid it holds, instead of the amount of real beer.

The ratio of the electric power in watts to the apparent power in volt-amperes is known as the power factor. With a non-inductive load, such as incandescent lamps, the kilovolt-ampere output may be the same as the kilowatt output, when the power factor becomes unity or 100 per cent. With an inductive load, such as motors; the kilovolt-ampere output is greater than the kilowatt output, and the power factor becomes less than unity. Thus it is seen that it is the load, and not the generator, which determines the power factor. A generator of a given kilovolt-ampere rating delivers twice the power in watts at 100 per cent power factor as at fifty per cent, though the current is the same in both cases. As the power factor decreases, the demand upon the generator increases.

The power factor frequently determines the rate. A 15 horsepower, or 20 kilowatt motor, for example, at 80 per cent power factor, makes a demand of 25 kilovolt-amperes on the generator. Hence a machine which could supply 100 kilowatts for lighting can only furnish enough current to run four instead of five 20 kilowatt motors. As a result the motor user should pay more per rated capacity in kilowatts than a lamp user taking an equal amount of power. With this explanation in mind the necessity of the kilovolt-ampere rating is evident and it is hoped that some of the perplexity has been cleared, and that no salesman will hereafter speak of a generator carrying 1000 k.v.a. at 80 per cent power factor.

Value of Service

Since the public service commissions have taken from the public utility companies the highest privilege of ownership, the right to fix the price at which their wares are sold, it behooves the public to understand and appreciate the fundamental principles upon which rates are based. One method, as developed in these columns last week, assumes the different costs of differing services to be the chief reason for rate discrimination in private business, "discrimination" being used in its original meaning, "to distinguish accurately," and not "to treat unequally."

Another viewpoint which is gaining much recognition is that which bases the rate upon the value of the service. For example, a butcher who pays eight dollars per hundred pounds for a beef cannot sell a hundred pounds of porterhouse steak nor a hundred pounds of soup meat for the average price per hundred pounds of the steer plus the proper proportion of his operating and overhead expenses. Should he try to do business in this way, his price for steaks would be less and his price for soup meat would be more than their value to his customers, and his business would be ruined, because he did not base his prices upon the law of supply and demand.

The analogy with electric rate-making is perfect. Off-peak current is a by-product which would be wasted if not sold at a lower price than that charged for continuity of lighting service. Other examples can be cited where a lower price is charged for a more expensive service in order to equalize the demand. The actual expense of sending a night message by telegraph is higher than that for a day message; it costs more to construct an upper than a lower berth in a Pullman car; yet the service is of less value and so the rate is lower.

Both these factors of cost and of value of service must be given due weight in determining a rate which will secure the best service at the least charge practicable for such service. This ideal is far more likely to be attained by a policy of co-operative regulation, a method which gives an incentive to good management, than one of restrictive regulation which stirs antagonism between the public and the corporation and places the manager who makes his profits by efficiency and economy on the same level with the man who tries to accomplish this result by extortionate charges. It is a narrow mind which seeks to destroy the business which is making money by converting to private profit something which may have once belonged to the State, but which served neither the State nor the people until harnessed by private initiative.

While such a scheme of dual rate regulation may not appeal to the exact mathematical mind of one who delights in fixing the precise percentage of profit on the basis of physical valuation, it is far better adapted to secure to the public the good service which they demand.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Yohann Seitz, an electrical engineer of Vienna, was a recent visitor in San Francisco.

F. W. Kitson, Spokane representative of the American Ever Ready Company, was in Seattle recently.

R. J. Kennedy, of the American Electric Heater Company, Detroit, Mich., is making a tour of the Northwest.

Glenn H. Marston, associate editor "Public Service" Chicago is covering the Pacific Coast investigating utilities.

L. J. Brown, lamp specialist of the Western Electric Company, San Francisco, has returned from a three weeks' trip East.

James H. Owen of Los Angeles, president of the Crescent City Light, Water & Power Company, was at San Francisco this week.

Thomas Mirk, vice-president Hunt, Mirk & Company, San Francisco, made a business trip this week to the southern part of California.

G. H. Curtiss, salesman for the Pacific States Electric Company, spent the major portion of the week on a business trip to Sacramento.

A. E. Griswold of the Griswold Manufacturing Company, Seattle, is spending a week in San Francisco, en route to Southern California.

J. P. Carson Jr., connected with the Northern Electric & Manufacturing Company, Vancouver, B. C., was in Seattle last week on a business trip.

M. S. Orrick, city sales manager of the Western Electric Company, San Francisco, arrived from Salt Lake City and assumed his duties last Monday.

F. H. Leggett, sales manager of the Western Electric Company, San Francisco, left during the week for a ten days' trip through the Pacific Northwest.

C. V. Schneider, of the Electrical Supply Company, Sacramento, visited San Francisco last week en route to the Electrical Contractors' convention at Santa Barbara.

L. H. Baldwin, northwestern representative Kellogg Switchboard & Supply Company, has returned to San Francisco from an extended business trip in the northwest.

Henry Ward Beecher, manager Seattle office, Charles C. Moore & Company, has returned from a trip to Butte and other Montana points, where he has been in the interests of the company.

E. J. Phillips, general manager United Farmers' Telephone & Telegraph Company, Gardnerville, Nevada, was at San Francisco this week en route through the state on an automobile tour.

G. W Canney, in charge of the service department Westinghouse Electric & Manufacturing Company, who is touring the West on an inspection trip, arrived in San Francisco from Chicago during the week.

G. B. Rosenblatt, metal mining engineer of the Westinghouse Electric & Manufacturing Company, is a recent arrival in San Francisco, and left Tuesday evening for a short trip to the California mining districts.

R. D. Holabird, of Holabird, Reynolds Company, San Francisco, returned from Lake Tahoe, where he had been spending a vacation period to take part in the annual jinks of the Bohemian Club at Bohemian Grove.

G. D. Jones, electrical engineer, department of engineering, Sacramento, was a recent visitor in San Francisco, leaving the latter part of the week for Agnews in connection with an electrical installation at that point.

Ralph Phelps, manager of the safety insulated wire department of Pierson, Roeding & Company, has just returned from a week's sojourn at Bohemian Grove, where he immortalized himself among the club members by his excellent presentation of the part of the prince in the Fall of Ug.

J. A. Crosby, sales manager of the American Cross Arm Company, Chicago, who is making a tour of the Pacific Coast, and Mr. Cook, the company's representative at Centralia, Washington, were visitors in San Francisco during the week.

W. R. Powder, who has been appointed Pacific Coast representative of Hubbard & Company and Pittsburg Re-inforcing Pole Company, arrived in San Francisco during the past week to assume the duties connected with his recent appointment.

W. L. Goodwin, vice-president of the Pacific States Electric Company, San Francisco, left Thursday for an extended trip East, where he will attend eastern manufacturers and attend the National Jobbers' meeting at Chicago, September 9, 10, 11, 12.

J. C. McQuiston, manager of Westinghouse Department of Publicity, and **H. W. Cope,** assistant manager of the Industrial and Power Department of the same company, arrived in San Francisco the latter part of the week from East Pittsburgh. During their stay details of the company's exhibit at the Panama-Pacific Exposition are to be decided upon.

B. F. Bush, president of the Denver & Rio Grande, the Missouri Pacific and the Western Pacific railroad systems, who was recently in Salt Lake City on a trip from Twin Falls, Idaho, reports that engineers are drawing up plans, specifications and estimates of the cost to electrify the road between Salt Lake and Grand Junction. No definite action will be taken until the engineers have made a complete report.

S. L. Nicholson, general sales manager of the Westinghouse Electric & Manufacturing Company, with headquarters at East Pittsburgh, Pa., accompanied by **D. S. Brown,** of the sales department of the company at the same city, is making an annual tour of the Pacific Coast offices of the company. The gentlemen expect to spend a week or ten days in San Francisco, leaving for Los Angeles and making visits to the company's offices at points enroute.

Stephen L. Coles has been appointed acting secretary-treasurer of the Society for Electrical Development, vice Philip S. Dodd, resigned. As announced in these columns several months ago, Mr. Coles' services were retained by the society as director of publicity. For the past four months the society has loaned Mr. Coles to the Toronto Electric Light Company, Ltd., of Toronto, Ontario, where he has been engaged with constructive service and advertising problems.

Vladimir Karapetoff, professor of electrical engineering at Cornell University, is making an extended visit to the principal western hydroelectric developments and high-tension power transmission plants. His itinerary includes the recent development on the Mississippi River at Keokuk, Iowa, also Denver, Salt Lake City, Los Angeles, San Francisco, Portland and Seattle. He expects to attend the Pacific Coast Convention of the American Institute of Electrical Engineers in Vancouver, B. C., September 9-13, and from there will return to the East in time for the beginning of the school term. Mrs. Karapetoff will accompany her husband.

Genichro Ohata, electrical engineer for the Imperial Department of Communications, Tokio, Japan, is at San Francisco on an extended trip over the United States. Mr. Ohata is studying power and telephone transmission and the relations of the power and telephone companies as regards inductive interference. He expects to leave the end of the month for Chicago and other eastern points where he will continue his investigations. According to his reports the electrical business in Japan is in a prosperous condition. The Inawashiro Hydroelectric Company is building a 115,000 volt, 70,000 kw. transmission line from the hydroelectric development at Lake Inawashiro to Tokio. He thinks that in a few years that there will not be less than 200,000 kw. developed in this region.

Mr. Coles has had twenty-five years' experience in daily newspaper, magazine, weekly and advertising agency work, and was for several years managing editor of the Electrical Review. His electrical education was obtained at the Massachusetts Institute of Technology and in the field during the formative period of the electrical industry.

Philip S. Dodd has resigned his position as secretary-treasurer of the Society for Electrical Development in accordance with an understanding made at the time he took the office. Mr. Dodd first attracted attention through his work on the Electrical Review, of which paper he subsequently became business manager. From the publishing business he went to the National Electric Lamp Association as director of its department of publicity. Here his work in furthering the co-operative ideas of Mr. J. Robert Crouse proved so successful that he was unanimously selected as the junior executive officer of the Society for Electrical Development. His enthusiasm and perseverance have won him a prominent place and his abilities in advertising and in organization work are recognized as exceptional. A host of friends will regret his leaving and wish him every success in his new work.

OBITUARY.

A. S. Michener, vice-president and comptroller of the Puget Sound Traction, Light & Power Company, was drowned in the Homa Homa River, a tributary of Hood Canal, Sunday morning, August 3. Mr. Michener was a member of a yachting party, leaving Seattle on Saturday expecting to fish and cruise in the vicinity where his death occurred. He was carried off his feet while attempting to ford the river, the force of the current dashing him against a rocky cliff. The deceased was born at Washington, D. C., and for the past 10 years had been with Stone & Webster. He did much to promote democracy among the employees and took a deep interest in municipal affairs. The remains were sent to his former home at Washington, D. C., accompanied by his widow and other relatives.

Sidney C. Thompson, electrician for the Southern Pacific Company at Ogden, Utah, was electrocuted on the 4th, by the same current which claimed the life of his brother-in-law, Morris C. Fretwell, a few days before. While engaged in refusing a transformer at the top of a signal tower, he fell directly across the wires and transformer and his body was frightfully burned. Mr. Thompson was born in Salt Lake, but had spent the greater part of his life in Ogden. He is survived by the widow and a three-year old son.

TRADE NOTES,

William A. Mullins Electric Company, Tacoma, has been awarded the contract for installation of lighting fixtures, glassware and lamps in the new Central high school building in that city at $2150.

J. J. Agutter & Company, Seattle, have the contract for electric wiring in the new buildings being erected by the state at the Hospital for the Insane at Sedro Woolley, Washington, at $5460.

The American District Steam Company, through its Seattle representative, E. L. Barnes, has contracted with the Phoenix Heating Company of Butte, Montana, for a complete underground heating system. A contract has also been closed with the Missoula Light & Water Company for about one mile of underground heating mains.

The design and construction of the new gas plant and distribution system to be installed at Laurel, Miss., this year, has been placed with Henry I. Lea, consulting gas engineer, Chicago. Plans and specifications are now being prepared, and bids will be requested by Mr. Lea probably within the next two weeks. The financing of this project is being done by the general service corporation of Philadelphia.

NEWS OF THE CALIFORNIA RAILROAD COMMISSSION.

The Pacific Gas & Electric Company applied for authority to issue $5,000,000 of convertible general lien bonds in place of the $5,000,000 of convertible debentures previously authorized, for its Bear River development and for general improvements to its system.

A decision was rendered in the case of V. A. Solari et al. against the Tuolumne County Electric Power & Light Company, ordering reductions in the lighting rates in the territory surrounding the city of Sonora.

A decision was rendered today granting the application of H. G. Lacey Company, which operates a lighting plant in Hanford, to issue promissory notes in the sum of $20,000.

The Southern California Edison Company was granted a certificate of public convenience and necessity to construct a gas distributing system in Chino and to operate under franchises previously granted in San Bernardino County.

The San Diego Consolidated Gas & Electric Company was granted authority to issue $102,000 of bonds, being part of a previous authorization of $639,000.

A decision was rendered granting authority to the Torrance Water, Light & Power Company to issue $115,000 of bonds and $34,000 of stock.

A decision was rendered authorizing the Southern Counties Gas Company to issue $75,000 of bonds for additions and betterments to its plant.

The commission has ordered all common carrier telephone companies to furnish by October 1st a detailed statement of their organization, equipment and physical and financial operations.

The Southern Counties Gas Company has applied for authority through M. S. Wilson, its counsel, to issue $100,000 30-year 6 per cent bonds of the denomination of $500 each.

The commission has granted the application of the H. G. Lacey Company, which operates a lighting plant in Hanford to issue promissory notes in the aggregate of $20,000.

The Sacramento Valley Electric Railway has applied for a modification of an order made last August requiring the road to have $750,000 cash in its treasury before beginning construction.

The commission has granted a certificate of public convenience and necessity to the Southern California Edison Company for the construction of a gas distributing system in the city of Chino. The same company has received a similar certificate for the exercise of franchises previously granted in San Bernardino county.

The commission has dismissed the application of the Lompoc Gas & Electric Company to issue $75,000 in bonds to purchase an existing plant at Lompoc. The commission had previously directed that the application should be modified before it could obtain approval. No modification was made.

The Pacific Light & Power Company has been granted authority to issue $2,500,000 at par value of its first preferred capital stock, the money to be obtained from sale of said stock, to be used in development of the Big Creek power project in Fresno county.

The Oakland, Antioch & Eastern Railway Company has applied for a ruling to determine whether $500,000 of its bonds placed on contract were legally issued. The carrier asks that in case the commission should determine that these bonds have not been legally issued, authority be given to issue them.

The commission has granted authority to the Pacific Gas & Electric Company to refund promissory notes to the amount of $319,000.

Authority was granted to the Pacific Telephone & Telegraph Company to purchase the Saratoga Telephone Company located at Saratoga, Santa Clara county, for $3,000.

The commission has denied the application of Mt. Jackson Water & Power Company to issue $11,000 in bonds.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

SUGGESTIONS TO THE OREGON ELECTRICAL CONTRACTORS' ASSOCIATION FOR MUTUAL IMPROVEMENT OF THE CONTRACTING BUSINESS.

BY F. H. MURPHY.[1]

There are many ways in which the members of this organization can be of help in improving electrical conditions. You have an exceptional opportunity to exert a great influence either for or against electric lighting and the use of electric equipment. Every poor job of wiring, every unnecessary delay in completing a piece of work, every failure to provide for the additional outlets and switches, which mean so much in the way of convenience and really increase the cost so little, every fixture installation which produces glare or causes tired eyes and headaches or insults the artistic sense, exerts a definite and appreciable influence against the use of electrical devices.

On the other hand, every satisfied customer is a walking advertisement for you in particular and for the use of electricity in general. I realize that to always do all these things to the satisfaction of every one would be impossible, but by united effort and persistent striving toward this end it will be possible to materially improve present conditions."

"By their works ye shall know them." It is impossible to over-emphasize the importance of doing work in a neat and systematic manner. It is an unsolved problem in my mind why any one can figure that it is better to wire a cutout or distributing cabinet by placing the cutouts at random and criscrossing the wires until the result is a veritable Chinese puzzle, which neither the contractor nor any one else can solve when the job is completed without an endless amount of labor. Why not do a little previous planning and exercise the use of more care in running the circuits in horizontal and vertical lines, cabling them together wherever this is possible? Still a better method is to use standard distributing panels in buildings where the cost will permit. This illustration of lack of method certainly cannot be excused on the theory that when trouble develops the original contractor, being the only one who knows anything at all about it, will be the one called in to remedy the evil, for such at present is an obsolete business principle.

Another decided advance might be made by members of this association by voluntarily placing on every distributing board or in every cabinet containing two or more circuits, a permanent typewritten record of each circuit, indicating the outlets controlled by it. This would entail little cost, and I believe it will eventually be made compulsory. It is a wise man, however, who anticipates legislation, and thereby feels no ill-effects upon its application.

In the matter of capacity of feeders and feeder pipe in the larger buildings, a great deal of missionary work may well be done. This is pre-eminently the electrical age. New ways are continually being devised for the use of electricity, and the field of present applications is being broadened so that it is not safe to provide merely for the load indicated on the plans, unless an unusually farsighted architect has designed the building. I realize that you must figure on what the specifications call for in order to compete; but if in your opinion the future has not been given proper consideration, take the time to show how the next larger size of feeder and conduit at a slight additional expense may result in the saving of several hundred dollars in the near future. It takes time for you to explain these things, and time is worth money, but you must look to the future for your pay. While immediate results are not likely, united concerted effort along the same line will produce the desired effect eventually. We must get above the principle that "Well, No. 0000 wire is what is required, and that is what the other fellow will figure on; but I will underbid him by figuring on No. 000, and take a chance on putting it through." That is one of the things that is hurting the contracting business now, and such methods should be denounced and exposed. Lend your hearty support to the City Inspection Department and encourage good, fair inspection.

Insistence upon having a good set of specifications drawn up for every piece of work of any size is another matter to which I would like to call your attention. Other work of importance is specified in detail, and there is no reason at all why electrical work, which is one of the principal essentials of a modern building today, should not receive equal consideration. Definite specifications, while not a panacea for all ills, will let the contractor know that he is figuring on the same thing that every one else must figure on, and that when he gets the work he will not be called upon to furnish something that he did not know was expected of him. On the other hand, it acts also as a protection to the customer in that he knows that he will get his work done as he wants it, and without a long, uncertain string of extras attached.

The next time you bid on work of any importance, call for complete specifications. If none are prepared, just mention a few of the advantages of having a set prepared for the next work. If the specifications are indefinite, encourage the preparation of a better, cleaner set next time. All this can be done without antagonizing the customer, and the psychological effect of each member of this association taking such a stand is certain to produce results eventually that will be worth while.

Your work is an educational one also along the general line of illumination, for many people will come to you, alone, for information as to what capacity to provide, what kind of fixtures, shades and lamps to install, where they should be placed, etc., and it is a duty you owe your customer as well as yourself to be able to give some good, helpful suggestions. If the case is too complicated, then send him to a specialist, in the same way that a good physician, when he detects a serious case of eye trouble, immediately sends the patient to an eye specialist.

Suggestions on Illumination.

"Illumination is the effect of which light is the cause." Good illumination is that illumination which enables us to do whatever it is necessary or desirable to do in that particular location with the maximum economy consistent with safety and comfort to the eye. This does not mean always the most efficient light source, or the highest intensity of illumination upon a given plane, or even that it always be a concealed source of light; but does mean a proper consideration of all these matters as they apply to each particular case.

In the first place, there must be sufficient "light" provided, and in examining a set of plans it is well to check them over to assure yourself that sufficient wattage has been provided to permit the various rooms to be well illuminated. It is impossible to give any rule of thumb method that can be safely relied upon, as every case really deserves special consideration, but in general the following may be used:

For all the principal buildings in the brightly lighted downtown district provide at least 2 watts per square foot for the first floor and 1.5 watts per square foot for all floors above the first. Guest rooms in hotels about 1 watt per square foot, and hallways, storerooms, etc., about .5 watt per square foot.

For buildings outside the first-class district the wattage

[1]Illuminating Engineer, Portland Railway, Light and Power Company.

might be dropped to 1.5 watts per square foot for the first floor, and in outlying districts in a few cases as low as 1 watt per square foot.

For window lighting the wattage is based upon the lineal feet of window exposure, measured horizontally, and in the better lighted districts runs as high as 50 watts per lineal foot, while in the outlying districts 15 or 20 watts per lineal foot is sufficient. Window lights should always be placed upon circuits separate from all other lighting in the building.

For dwellings, flats and apartments the average capacity to be provided in each room should not be less than 1 watt per square foot, except in the case of attics, basements, closets and porches, where a lower limit may be used.

The capacity of purely decorative lighting outlets and of floor and baseboard outlets should not be included in the allowances made above.

In addition to the outlets for lighting, every "active" room in a building should be provided with one or more baseboard outlets to care for special electrical equipment that is certain to be used sooner or later, such as electric fans, additional lights, cooking or other heating devices, small motors, etc.

The more general use of switches should be encouraged as much as possible. The additional cost of installation is small, but the convenience cannot be fully realized until one has tried to get along without them. Besides, they cause a saving of lamps, energy (wattage) and patience. Urge particularly the use of 3-way switches for the control of upper and lower hall lights.

In the illumination of rooms, we have a complex problem. In general, the primary object is not to exhibit the fixture, but, as previously stated, to provide adequate light for the purposes for which the room is to be used. Tables of satisfactory illumination intensities are accessible, and values need not be given here; but to produce this intensity with maximum eye comfort, minimum energy consumption and yet produce an harmonious effect is the problem.

Leaving, however, the selection of a suitable fixture out of the question, we will consider a few points necessary to the securing of eye comfort. A room is usually well lighted that has a bright appearance, and in which the light source either is not visible or, if visible, is of low intrinsic brilliancy or surface intensity. This brightness may be secured with minimum energy consumption when the walls and ceiling are light, but with dark walls and heavily beamed dark ceilings it is almost impossible to obtain this effect with any amount of wattage. The prospective builder should know this and remember that the electric system of lighting is not to blame, neither is the service company's meter, if he pays a high bill and still fails to get a bright room.

Whatever the nature of the walls or ceiling, the lamps should be kept up out of the line of vision as far as possible. This is, of course, accomplished in the indirect system, but in the semi-indirect and the direct systems it must be considered. Both these latter systems should have good diffusing glassware. This is usually secured in the semi-indirect without any trouble, but in the direct system we have an infinite amount of abuse to the eye, the purse and the artistic sense.

There is an endless variety of shades and reflectors from which to select something suitable for your direct lighting installation. Many are worthless, but there is also a large number that will give excellent results and at the same time give ample freedom for the gratification of the artistic sense.

It has been proven that light walls are not necessary to the efficiency and comfort of the eye working under these conditions; in fact, medium walls are better than light ones. This is probably due to the fact that the eye gets less direct reflection, and hence the pupil opens farther and works with greater ease. Also, upon glancing up from the work the eye encounters a dimly lighted surface and is rested. Such a room will not appear as bright as one with light walls, but if good judgment has been used in the selection of wall tints the sacrifice in general brightness is well counterbalanced by the gain in eye comfort.

Briefly, then, in the selection of shades and reflectors remember that a "clear globe interferes with clear vision," and see to it that the lamp filament is completely hidden from the eye by means of a good diffusing medium. Select a shade that throws the maximum light downward within about a 60-degree zone, throws very little light onto the walls, but a somewhat larger amount upon the ceiling, which should always be light. Wire drawn tungsten lamps are now available in sizes from 8 c.p. to over 400 c.p., and are so rugged that there really is no need for further use of the carbon lamp, which consumes from two to three times the energy for the same illumination. With these lamps, however, it is all the more important to conceal the filament from the eye, and if the shade does not normally conceal the lamp from the eye, frosted lamps should be used.

As a general rule the use of brackets for residence work should be carefully avoided. It may be desirable occasionally to use a bracket in a large room in order to secure localized lighting, but in such cases the lamp should be treated as a table lamp and enclosed in a shade that will permit but little side light to escape. The same care should be taken to keep the surface intensity low where brackets are installed for purely decorative purposes. Only enough light should escape to bring out the beauty of the lamp or shade, yet not enough to tire the eye.

The proper lighting of show windows is another difficult problem. Unless you are displaying electrical fixtures for sale, it is never permissible to have the lamp and reflector visible from the street. Place the fixtures above the glass if possible; it not, have an opaque border painted across the top of the window that will conceal the reflectors. The type of reflector and the spacing used should be such as to produce a uniform illumination over the goods on display. Each window is a special case, however, and should in most cases be handled by some one who has had experience in this line of work. Concisely stated, then, good window lighting means concealed fixtures and a uniform distribution of light of sufficient intensity to clearly display the goods.

After the lighting system has been installed, even though it has been properly done, it will not continue to give satisfactory results unless it has the proper care, and this, of course, you will probably feel is out of your province. Much can be done, however, by impressing upon the customer that his installation will not continue to give him good results without regular attention to cleaning it, any more than an automobile will continue to give good and continuous service without supplying the bearings with lubricating oil. Why it is that people will clean and polish everything else in the room, but refuse to touch the electric lamps and shades is a mystery; but such is the case, and it is much easier to warn them of the danger than it is to explain to them later why they are not getting satisfactory service from their installation.

After three or four weeks the loss due to dirt runs about 8 to 12 per cent for the average business or public installation, and where the installation has had no attention for three or four months the loss will amount to 25 per cent or 30 per cent. The tendency to burn lamps long after their useful life is over is altogether too prevalent also. In one installation of tungsten lamps we found a depreciation of 42 per cent, due entirely to blackened lamps. These lamps had burned about 3000 hours, whereas the useful average life of a lamp is about 1000 hours.

If the contractor will impart some of this knowledge to the new customer at the time the installation is completed he will find a receptive field for the good seed to fall in and the yield will be a contented and a continued customer.

PROGRAM FOR NORTHWEST ELECTRIC LIGHT & POWER CONVENTION AT SEATTLE.

Wednesday, Sept. 3, 10:00 A. M.

1. Address of Welcome, by J. E. Childberg.
2. Address of President W. J. Grambs.
3. Announcements.
4. Report of Secretary and Treasurer.
5. Reports of Committees.

Wednesday, Sept. 3, 2:00 P. M.

Operating Paper: Management and Operation of an Electric Light Plant in a Small Town, by E. G. Robinson, manager Jim Creek Water, Light & Power Company, Arlington, Washington.

Operating Paper: Some Operating Problems, by J. B. Fisken, Superintendent Light & Power, The Washington Water Power Company, Spokane, Washington.

Commercial Paper: "The Tireless Farmer," Results from Ruralizing Electricity, by J E. Davidson, vice-president and general manager Pacific Power & Light Company, Portland, Oregon.

Thursday, Sept. 4, 10:00 A. M.

Administrative Paper: The Regulation of Public Service Utilities, by Geo. A. Lee, ex-chairman of the Public Service Commission of Washington.

Administration Paper: Recent and Proposed Legislation Affecting Public Utilities, by Norwood W. Brockett, Puget Sound Traction, Light & Power Company, Seattle, Washington.

Appointment of Nominating Committee.

Thursday, Sept. 4, 2:00 P. M.

Accounting Paper: Mechanical Devices in the Accounting Department, by Y. M. White, treasurer, The Washington Water Power Company, Spokane, Washington.

Address, The Valuation of Electric Utilities, by Henry L. Gray, former chief engineer of the Public Service Commission of Washington.

Commercial Paper: Management of a Commercial Department, by A. C. McMicken, sales manager, Portland Railway, Light & Power Company, Portland, Oregon.

Friday, Sept. 5, 10:00 A. M.

Engineering Paper: Use of Protective Relays on Transmission Systems, by S. C. Lindsay, Electrical Engineer, Puget Sound Traction, Light & Power Company, Seattle, Washington.

Engineering Paper: Some Features of the Washington Construction Rules, by V. H. Greisser, electrical engineer, The Washington Water Power Company, Spokane, Washington.

Commercial Paper: The Industrial Application of Electrical Heating, by W. H. Lines, industrial power engineer, Portland Railway, Light & Power Company, Portland, Ore.

Friday, Sept. 5, 2:00 P. M.

Commercial Paper: Electricity in the Lumber Industry, by A. E. Ransom, manager Seattle office, Caldwell Machinery Company, Seattle, Washington.

Operating Paper: Synchronizing an Electric Light & Power Company's Records and Accounts with the Characteristics of Its Business, by O. B. Coldwell, general superintendent light and power department, Portland Railway, Light & Power Company, Portland, Oregon.

Executive Session. Adjournment.

The committee having charge of entertainment at the convention has provided for the following diversions: On the evening of the 4th a Jovian rejuvenation will be held and the ladies will be taken care of at a theater party. On the afternoon of the 5th about 4 o'clock there will be an automobile ride for everyone, followed by a banquet for the men and a separate special dinner for the ladies. On Saturday the 6th there will be an excursion to the navy yard for all. Arrangements have been made with officials in charge to have everything thrown open to the visitors.

EXAMINATION FOR RADIO ELECTRICIAN.

The United States Civil Service Commission announces an open competitive examination for radio electrician, on August 20, 1913, at $4.48 per diem, in the Navy Yard, New York, N. Y. The duties will be primarily the installation and repairing of radio apparatus, including all adjustments and tuning of new sets, testing radio material received under contract, and assisting in experimental work conducted at the radio laboratory. Applicants for this position should be practical electricians with not less than four years' experience in special radio work or the manufacture, installation, and adjustment of wireless apparatus. It is desirable, but not essential, that they be wireless telegraph operators.

The commission also announces an examination for radio sub-inspector, on August 20, 1913, at $6 per diem, and a vacancy in the position of assistant radio sub-inspector at $4 per diem, in the Navy Yard, New York, N. Y. Competitors will be examined in theoretical and practical questions in the construction, use, and adjustment of radio apparatus and auxiliaries. Applicants for the latter should preferably be graduates of high class technical schools and have taken a course in electrical engineering or a special course in wireless telegraphy; also should have had several years' experience in the manufacture, installation and adjustment of wireless apparatus. They should be expert operators and be able to prepare useful reports of inspections and tests.

PORTLAND SIGN ORDINANCE.

In a previous issue we stated that the electric sign ordinance in Portland, Oregon, had been amended to allow lens signs, but the same has been held up by the commissioners to allow the manufacturers of signs which use the "outline system" to demonstrate the bad features of the "bus type." If they are successful the ordinance will not be amended. At present the vote stands three against and two in favor of amending the ordinance.

NEW CATALOGUES.

Bulletin No. 246 from the Sprague Electric Works of the General Electric Company, illustrates and describes motor-driven exhaust fan outlets for both direct and alternating current.

The U. S. Electrical Manufacturing Company of Los Angeles is distributing two interesting catalogues on their new type FR constant speed riveted frame Polyphase Induction Motors ¼ to 15 h.p., 2 and 3-phase.

Henry I. Lea, consulting gas engineer, Peoples Gas Bldg., Chicago, is distribuing a beauifully printed record of seven years' experience in the design, construction, management rate making and valuation of gas plants.

The Westinghouse Electric & Manufacturing Company has just issued leaflets Nos. 3572 and 3660 covering the electrification of the Pennsylvania-New York Extension of the Pennsylvania Railroad, and the New York, New Haven & Hartford Railroads, respectively. Descriptive Leaflet No. 3571 covers the Commutating-Pole Rotary Converters. "Electris Arc Welding Processes" (catalogue section 3049) is a reprint of an article recently appearing in the technical press by Mr. C. B. Auel, director of processes, standards and materials of the Westinghouse Company. This paper, which is well illustrated, explains in an interesting manner the different processes employed in arc welding, their advantages and limitations, and gives some interesting figures of comparison of arc and blacksmith welding. Descriptive Leaflet No. 3685 covers Type SK Direct-Current Commutating Pole Generators from 1½ to 200 kw., 125-250 volts. The leaflet shows complete and detailed views of the construction and describes the general features of the machine.

NEWS NOTES

INCORPORATIONS.

SEATLE, WASH.—The Electric Traffic Signal Company has been incorporated for $35,000. Joseph Harkins is the principal stockholder.

REDWOOD CITY, CAL.—Halfmoon Bay Light & Power Company has been incorporated for $25,000, by F. N. Staley, J. J. Comes, Jos. Fernandez, Benj. Cunha and Manuel Cardoza.

WINLOCK, WASH.—The articles of incorporation of the Winlock-Chehalis Water Company, with a capital stock of $25,000, has been filed by C. E. Leonard, Christian Peterson and Martha Leonard.

OLYMPIA, WASH.—The Washington Public Service Company has been incorporated for $1,500,000 and will enter the light and power business. W. B. Foshay and Millard Lemon are at the head of the company.

ILLUMINATION.

NATIONAL CITY, CAL.—A new street lighting system for this city is now under consideration, by the board of trustees, the present system being unsatisfactory.

PORTLAND, ORE.—A comprehensive investigation to determine the feasibility of a municipal electric plant for lighting streets and public buildings in Portland has been started by Mayor Albee and members of the city commission.

HEPPNER, ORE.—Plans are under way to rebuild and enlarge the Heppner Light & Water Plant. A 24-hour service will be provided for, which will necessitate the building of another building as large or larger than the one that now covers the plant.

SACRAMENTO, CAL.—A communication from John A. Britton, president of this company, was presented to the city commissioners by Attorney L. T. Hatfield, requesting permission to abandon four franchises to construct lines in various parts of the city. The return of $10,000 bonds for the fulfillment of the contract is also asked.

OWENSMOUTH, CAL.—Contracts for the installation of a lighting system in Van Nuys Highway District, have been awarded by the county supervisors as follows: Llewellyn Iron Works, posts, $13,100; installation, Newberry-Bendheim Company, $36,045.40. The total cost of the installation will be $49,145.40. Work on the system will commence at once.

HELENA, MONT.—Resolutions creating special lighting improvement district No. 85 to provide for the improvement of Fifth avenue, from Rodney street to Montana avenue with curbs and ornamental lamp posts were adopted at the last meeting of the city council. The work will not be started until next spring, in order that cold weather may be avoided.

EUGENE, ORE.—Immediate construction at Springfield of the most modern sawmill in the northwest has been announced by A. C. Dixon, manager of the Booth-Kelly Lumber Company. Electrical power is to be used throughout the mill, which will be built to cut something in excess of 30,000,000 ft. a year.

SAN FRANCISCO, CAL.—The board of directors of the Pacific Gas & Electric Company has called a special meeting of stockholders of the company to be held September 10th, for the purpose of authorizing an issue of 6 per cent gold notes, of a maximum value of $7,000,000, to mature June 26, 1914, and to be secured by pledge of collateral of $5,000,000 par value general and refunding bonds and $5,000,000 par value general lien 6 per cent bonds, both of which issues have heretofore been authorized by the stockholders of the company. This collateral will be deposited from time to time with the Bankers' Trust Company, New York, trustee, under the gold note agreement, when and as such funds are turned over to the company from the proceeds of the loan. It is announced that a contract has been made under which bankers heretofore identified with the company's financing will purchase $4,500,000 of these notes immediately upon their authorization by the stockholders. The proceeds will be used as follows: (a) To take up demand notes for advances already made by the bankers and yet to be made pending authorization of the gold notes by the stockholders; (b) to pay other current indebtedness of the company, for the prosecution of necessary construction work and the extension of the company's business. The remainder of the authorized issue not disposed of to the bankers at this time, namely, $2,500,000, will be reserved to meet possible future needs of the company.

TRANSMISSION.

BINGHAM, UTAH.—Fire caused by lightning resulted in the destruction recently of the transformer and compressor plant of the Utah Copper Company here. The plant was practically new. Loss, $100,000.

BOISE, IDAHO.—A proposition is under way to construct a large power plant in Idaho for pumping water and supplying electricity for heating purposes to the towns of the Boise Valley. All are included in the plans for the reclamation of 44,700 acres of land under the Owyhee Irrigation District. The project calls for an expenditure of $3,000,000, and the water will cost the settlers $60 per acre.

TACOMA, WASH.—The Tacoma Railway & Power Company is making a 13 mile extension to its 13,000 volt, 3-phase system to the E. I. du Pont de Nemours powder plant at du Pont, Washington. The transformer station at the powder plant will contain for the present load, 2-150 kw. self-cooled, Fort Wayne transformers 13,000 to 2200 volts. For protection there will be an automatic 13,000 volt oil switch on the incoming lines and automatic 2300 volt oil switch on the secondary side.

ELKO, NEV.—An electric power plant is to be constructed on the South Fork stream above the Clayton ranch, according to information received here. California capitalists have secured the water rights and a short time ago sent Leon M. Hall, a San Francisco engineer, to examine the site. He has returned from a visit to the district and expresses himself as highly satisfied with the opportunities offered. He says that there is enough water and natural fall to develop 10,000 h.p. and that the first unit installed will be from 3000 to 5000 h.p. Southern mining camps, Bullion, Round Mountain and Ely in particular, will receive the power.

TUCSON, ARIZ.—In order to care for the increasing demand for electric power service for pumping and irrigation requirements of the Tucson Farms Company, the Tucson Gas, Electric Light & Power Company, are installing an additional high voltage transformer station with several hundred h.p. capacity in the vicinity of the upper pumping plant of the city waterworks. Estimates for other high voltage power line extensions and substations sufficient to care for the demands of the irrigation pumping service throughout Santa Cruz and Rillito valleys north of the city, are now being prepared and extensions will likely be made soon.

TRANSPORTATION.

PRINEVILE, ORE.—A contract has been closed with H. P. Scheel of Tenino, Wash., for the construction of a standard gauge steam or electric railroad from Metolius

to Prineville. The construction work will start as soon as the right of way and other preliminaries are disposed of. It is undecided whether electricity will be used at first or not, but it will ultimately be an electric line.

OAKLAND, CAL.—The directors of the Oakland, Antioch & Eastern Railway have decided to levy an assessment of $5 a share on the 100,000 shares of capital stock outstanding, payable September 11, which will realize $500,000 to be devoted to the purchase of equipment.

SALT LAKE, UTAH.—The Utah Light & Railway Company will soon begin work on a substation at Bountiful, which will supply power for their new interurban line between that city and Salt Lake. The substation will contain a 500 kilowatt motor generator set and auxiliary equipment, but is being built large enough to contain additional apparatus in case the company decides to extend its lines further north. Energy will be taken from its 45,000 volt transmission line between Salt Lake and Ogden.

FRESNO, CAL.—Negotiations are under way whereby the Central California Traction Company, running from Stockton to Sacramento is to take over the operation of the Tidewater & Southern, operating between Stockton and Modesto. Announcement was made by W. F. Fuller, who has just been appointed general agent for the Tidewater & Southern, and by Leo H. Landis, traffic manager, that the Tidewater will be running as an electric road into Modesto by October 1st.

TELEPHONE AND TELEGRAPH.

SEATTLE, WASH.—The Pacific Telephone & Telegraph Company announces its intention of erecting a $25,000 brick exchange building on Capitol hill. The equipment planned will cost approximately $70,000 and the exchange will serve 4400 subscribers.

OAKLAND, CAL.—The shops and supply department of the Western Electric Company will be moved to Oakland soon. The new warehouse and shops will be established in the building erected some years ago and partly used by the company, at Halleck and Hollis streets, near the Emeryville town line. This structure will be enlarged and reconstructed, and work will begin at once.

LONG BEACH, CAL.—The city began an attack on the Home Telephone Company franchises here when warrants were prepared at the instance of City Attorney Long for the arrest of George B. Ellis of Los Angeles, president of the company, and Percy Copeland, local manager, charging them with having collected excessive service rates without authority from the city government. Proceedings will be instituted to forfeit the company's franchises.

SALT LAKE, UTAH.—The Western Union Telegraph Company are planning to abandon as the principal telegraphic highway west of Ogden the aerial cable across Great Salt Lake parallel with the Ogden-Lucin cut-off, on account of damage due to the action of the salt water. The company has a force of 150 men employed in the construction of a new 146-mile line around the north end of the lake, which, when completed in the fall, will be used as a main channel. The work is under the supervision of F. E. Horton, superintendent at Salt Lake.

SAN FRANCISCO, CAL.—A. H. Ginman, manager of the Pacific Coast division of the Marconi Wireless Telegraph Company, reports that his company will soon erect a 25 kw. station at Ketchikan and a 10 kw. station at Juneau, Alaska. The erection of these two plants will cost approximately $60,000. Stations will also be erected at Cordova and Dutch Harbor. The installation of the new stations insures wireless communication with the north by the entire Pacific Coast. Ginman also announced that a sweeping reduction in rates would take place on Sept. 1.

WATERWORKS.

ENDICOTT, WASH.—Bids will be received until August 30th for the construction of a complete water system.

SAN DIEGO, CAL.—San Diego citizens are to be asked to vote $955,000 in bonds for water development and improvement. Date of election has not been set

AZUSA, CAL.—At a meeting of the Chamber of Commerce it was proposed to take up the matter of initiating a move for a bond election to improve the water and light systems of Azusa. For this purpose it is proposed to issue bonds for about $30,000.

LEWISTON, IDAHO.—A pipe line capable of serving the city of Lewiston, built from Lake Waha to the city, would cost about $150,000, according to an estimate of the county engineer, Eugene Boothe, and Water Superintendent Wagner. The city administration recently asked for an estimate.

MALDEN, WASH.—The Washington Public Service Commission has ordered the Malden Water Company of Malden, Washington to start within a year the laying of mains and clearing of dead ends and must within 30 days of the filing of this order by the commission file a new revised schedule of rate tariffs.

OXNARD, CAL.—By a vote of 200 to 17 the city has been ordered to purchase the waterworks system of the Ventura County Power Company, using therefor bond issue of $30,000, voted some time ago for street lights. The waterworks system will be incorporated with the new municipal plant now under construction.

SAN FERNANDO, CAL.—Steps towards acquisition of a municipal water plant have been taken by the city trustees, meeting with the chamber of commerce, and considering the purchase of the local water system, owned by the Consolidated Securities Company. The company offers its plant and water rights for $50,000.

BURLINGAME, CAL.—The Burlingame city water commission has authorized Mayor G. J. McGregor to arrange for the purchase of a site for the municipal reservoir in the hills back of Easton, where the elevation will provide a sufficient pressure. The contract for the furnishing of supplies for the distributing system has been awarded to the Mark Lally Company for $75,659.71, less the cost of hydrants, meters and meter boxes.

EL CAJON, CAL.—In order to secure more adequate water pressure and obtain reduction in insurance rates, the El Cajon board of city trustees proposes to issue $50,000 worth of bonds, and build a municipal water system. The plans for a water plant, now being prepared by the city engineer, include sinking of several wells at a point near Santee, construction of reservoir on hill and laying of water mains throughout the city.

PHOENIX, ARIZ.—Girand, Hasse & Lewis, constructing and consulting engineers, of Phoenix, have been awarded the contract for designing and constructing the proposed water works plant for Wickenburg. The plans, as yet only preliminary, will probably call for concrete reservoir with a capacity of about 100,000 gallons, to be supplied by pumps. Mains are to be laid in most of the streets of the town, and a suitable concrete building to house the pumping plant will be erected.

SAN FRANCISCO, CAL.—The supervisors have denied the petition of the Spring Valley Water Company for a reduction of the assessment on its pipes, connections and underground construction. Assessor Ginty explained that the value of the company's pipes and other underground property had risen in recent years because of the paving of the streets in which the pipes were laid. The company, in its water-rate litigation, claimed additional value on this account for this part of its plant, reasoning that the present value should be based on what it would cost at this time to reproduce this property.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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ILLUMINATION AT TEMPLARS' DENVER CONCLAVE.

ELECTRICAL CONTRACTORS' CONVENTION, SANTA BARBARA, AUGUST 14-16.

APPLICATION OF WATER TO THE LAND.
BY B. A. ETCHEVERRY.

HYDRAULICS II.
BY O. C. GOLDMAN.

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Alphabetical Index to Advertisers, Page 8.

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ILLUMINATION AT TEMPLAR'S DENVER CONCLAVE

Some remarkable lighting effects were secured during the thirty-second triennial conclave of the Knights Templar at Denver, Colo., August 11-16. Their slogan "In Hoc Signo Vinces," in combination with Cross and Crown, figures of knights on horseback, was in evidence at all points of vantage during the week. The business district was transformed into a gallery of radiant colors by day, and a maze of dazzling, gleaming, vari-colored lights after 7:30 p. m. Conspicuous among the attractions were the following:

The Court of Honor on Champa street, extending from 14th to 18th, studded with forty-eight columns, each thirty-six feet high, lighted by electricity, crowned with a golden harp, reflecting a variety of dancing, shimmering colors from jets of water which gushed forth within the glass cylinders forming the upper half. These columns were symbolical of the forty-eight states.

At the Fourteenth-street end of the Court of Honor, powerful searchlights operated by a special device upon a framework built for the purpose, occupied the entire width of the street depicted the glory of a Colorado sunset, a realistic picture of the setting sun with rays stretching a thousand feet into the air against a dark background, and the word "Welcome" spelled out with 500 miniature lights.

The street illumination was arranged with festoons of red, white and blue lights hung in portiere fashion across Fourteenth street, three clusters to a block.

Views of the Decorative Effects at Knights Templar Conclave.

On Fifteenth street were rows of twenty 18-in. stars with white cross in the center and large arc lights enveloped in silver flitter. On the trolley poles were figures of the cross and crown outlined in papier-mache, surrounded by drapery of bunting, stars and stripes, four rows to each block.

On Sixteenth street, the red maltese cross was suspended in the center of two strings of red lights, between which was entwined, and caught up in loops five strands of silver tinsel.

In the business section where the regular wires were not capable of carrying the additional current required, extra cables were temporarily placed on the trolley poles, and special dynamos installed in the power house to re-enforce the permanent lighting system.

ELECTRICAL CONTRACTORS' CONVENTION.

The fourth annual convention of the California State Electrical Contractors' Association held at the Hotel Potter, Santa Barbara, California, August 14-16, will go down in history as one of the most successful and enjoyable yet held. While previous conventions have surpassed it in point of attendance none was of more direct value to those in attendance nor has any previous meeting laid the foundation for so much development in the year to come. The total attendance of electrical contractors and their guests was close to one hundred.

Wednesday, the 14th and Thursday, the 15th, were devoted to business meetings open only to the contractors. Motor rides throughout the beautiful country surrounding Santa Barbara were enjoyed by the ladies and on Thursday evening a boat ride along the coast was taken by the entire party.

Officers for the ensuing year were elected as follows:

President—C. V. Schneider, Sacramento.
First Vice-President—Claude Lovejoy, Santa Barbara.
Second Vice-President—George Sittman, San Francisco.
Secretary-Treasurer—W. S. Hanbridge, San Francisco.
Sergeant-at-Arms—Frank Somers, San Jose.

Sacramento was chosen as the next meeting place. Arrangements were made to carry on a vigorous campaign for new members during the next year, a prize of $50 being offered to the one getting the largest number to join.

C. F. Butte presided at the open meeting on Friday, the 15th. First on the program was an address about the Society for Electrical Development by A. H. Halloran. This was followed by a paper on the "Mutuality of Interest Between the Electrical Contractor and the Central Station," by J. P. Huntington. R. B. Clapp spoke on the Jovian Order and the secretary read a paper from John C. Austin on the "Relation of the Architect to the Contractor." In the afternoon J. B. Hyde spoke on State Regulation of Fire Alarm Installation, and J. R. Malony presented a paper on Compensation Laws. Several of these papers are published herewith. The annual dinner was held in the Moorish Room of the Hotel Potter on Friday evening, the time being pleasantly spent with feasting, song and story.

Saturday was devoted to athletic sports, with a Jovian rejuvenation in the evening. A five-inning baseball game in the morning between the Jobbers and the Contractors, resulted in a score of 17 to 9 in favor of the former, the jobbers making nine runs in the last inning. Fulton and Neelands were the battery for the jobbers and Arbogast and Jacobs for the contractors. Arbogast also pitched for the Southern Contractors in their game against the Northern Contractors in the afternoon, Spaulding catching for the Southern crowd, while Snyder and Hope did the honors for the North. The score was 5 to 1 in favor of the South after four innings. A barbecue lunch was served between the games and greatly enjoyed by all present. In the afternoon various other contests were held for which handsome prizes were awarded the fortunate winners.

Jovian Rejuvenation.

The rejuvenation on Saturday night was a notable exemplification of the spirit of co-operation inculcated by the Jovian Order. Statesmen and officers from Los Angeles and San Francisco got together in staging one of the most impressive ceremonies yet produced on the Pacific Coast. Each officer had memorized his part and delivered it in a most effective manner. From Los Angeles Statesman R. B. Clapp provided Jupiter, Pluto, Mars and four imps, while from San Francisco Statesman A. H. Halloran furnished Neptune, Vulcan, Apollo, Hercules, Mercury and Avrenim. Great credit is due to the men who so admirably occupied these positions, particularly to Statesman-at-large J. G. Pomeroy, who performed the executive duties of Jupiter in a most acceptable manner and was otherwise an active worker, as well as to Statesmen-at-large H. E. Sanderson, M. F. Steele and Statesman C. V. Schneider. Great personal sacrifices were made by several, E. B. Strong having come from San Francisco for the sole purpose of taking his part as Neptune.

The following officiated at the respective stations:

Jupiter—J. G. Pomeroy; Mercury—J. A. Vandegrift; Neptune—E. B. Strong; Mercury—H. E. Sanderson; Pluto—T. E. Burger; Apollo—M. L. Scobey; Vulcan—A. H. Halloran; Avrenim—Geo. A. Gray; Mars—A. L. Spring; Imps—B. C. Chase, W. L. Neelands, W. A. McNally, Phil Levy.

At the conclusion of the ceremony Statesman R. B. Clapp gave a strong address upon Co-operation; remarks also being made by Statesman Schneider and Halloran.

The following candidates were initiated into the mysteries of the order:

W. R. Edwards, Pacific States Electric Company, Los Angeles; L. J. Fraser, S. W. Surety Insurance Company, San Francisco; J. C. Jacobs, Jacobs Electric Company, Pasadena; T. L. Jepson, Jepson Salisbury Company, Ventura; J. H. Mosely, Journal of Electricity, Power and Gas, San Francisco; D. L. Reynolds, Reynolds Electric Company, Los Angeles.

Following is a list of the registrations at the Convention:

F. J. Airey	M. C. Hixson	Miss Hazel M. Pritchard
Mr. & Mrs. G. E. Arbogast	Mr. and Mrs. N. M. Hope	N. W. Reed
G. F. Becker	P. B. Hyde	Mr. & Mrs. C. A. Renard
Mrs. Bergman	Mr. & Mrs. Jno. C. Jacobs	Mr. & Mrs. J. C. Rendler
Mr. & Mrs. E. F. Burkhart	F. L. Jepson	Duncan L. Reynolds
Mr. and Mrs. C. F. Butte	C. E. Kenyon	Mr. & Mrs. J. S. Reynolds
W. E. Camp	W. W. Lane	H. E. Sanderson
J. M. Carlson	F. O. Lantz	H. A. Sayles
Benjamin C. Chase	Mr. and Mrs. Phil Levy	Mr. & Mrs. C. V. Schneider
Mr. and Mrs. R. B. Clapp	G. Loveberg	M. L. Scobey
C. K. Cooper	Mr. & Mrs. Claude Loveday	H. G. Shepherd
Mr. and Mrs. C. C. Davis	W. R. Lyall	G. A. Sittman
W. R. Edwards	J. R. Maloney	A. Allen Smith
Mr. and Mrs. E. J. Field	Mr. & Mrs. R. J. McHugh	Mr. & Mrs. F. J. Somers
A. R. Fierce	W. A. McNally	G. E. Spaulding
Mr. & Mrs. C. G. Fraukish	Miss Emma Meyer	Arthur L. Spring
L. C. Fraser Jr.	Mr. & Mrs. F. S. Mills	Miles F. Steel
Alexander Fulton	J. H. Moseley	W. M. Stockwell
G. Gans	F. H. Murray	E. B. Strong
Geo. A. Gray	Mr. & Mrs. W. L. Neelands	Lewis Switzer
S. B. Gregory	H. T. Nielson	Chas. L. Turner
A. J. Hall	Mr. & Mrs. Wylie Nielson	J. A. Vandegrift
C. B. Hall	L. A. Nott	V. A. Welch
W. B. Hall	M. W. Phillips	Miss Vencent Welch
A. H. Halloran	J. G. Pomeroy	W. T. Yost
Mr. & Mrs. W. S. Haubridge	F. B. Potter	Carl Young

MUTUALITY OF INTEREST BETWEEN THE ELECRICAL CONTRACTOR AND THE CENTRAL STATION.

BY J. P. HUNTINGTON.

The question of mutuality of interest is of paramount importance to all the branches of the electrical industry and when it is defective in one branch of the industry, all of the other branches are hurt in consequence. This burden of mutuality cannot be carried successfully by one or more branches and ignored by the others. I am reminded of the story about the farmer who had a pair of horses. He was asked if his team was a willing one and his reply was, "Yes, one is willing to do all the work and the other is willing to let it." In the electrical business in the past, we have sometimes seen one branch of the industry willing to do that co-operating and the other branch willing to take the benefits but not so willing to carry its share of the burden.

However, conventions like this and discussions of this order are what will bring about a condition which we all desire. My impressions are based on a year of central station operation in Southern California, following a number of years in the same line of work in four of the Eastern States. I have found conditions on the Pacific Coast in all branches of central station work to be different from the conditions existing in the older part of this country, and this difference extends to the mutual relations existing between the contractor and the central station companies. I have found the electrical contractor on the Pacific Coast, as a class, to be up to date, energetic, efficient, reliable, and possessed to a large degree of that initiative so necessary in any business. In all these things I feel that he averages higher than his Eastern brother and I assure you that one of the many pleasures I have experienced through my change of location has been due to the better relations existing between the electrical contractor and the central station, and the better understanding of the mutual interests that exist.

The mutuality of interest between us may be summed up in one word which embraces the whole subject—Co-operation. Co-operation is the first as well as last great duty that we owe to each other, and an actual necessity to the carrying on of our separate businesses. Co-operation is the solid foundation without which we cannot build the substantial structure of success—or—Co-operation is the double harness which allows us each to put our shoulders against the collar and pull evenly together for the success of both.

A constant study of co-operation should be the practice of us all, and a constant observance of co-operation should be the habit of all. Through co-operation we can attain the highest degree of successful service. Successful service produces a satisfied customer, and a satisfied customer is the greatest asset that either of us can have.

In good service we have an important item of mutual interest. Good service to a customer on the part of one of us is of great advantage to the other; in fact, each of us is bound to depend on the other for good service to the customers we jointly serve. The central station carries its lines to the wall of a customer's building, and there transfers the "juice" to the lines installed by the contractor. It is through the lines, fixtures and appliances furnished by the contractor within the building that the electric current furnished by the central station is carried and translated into light, heat, or power, as may be desired by the customer. If the central station renders poor service, the customer will become dissatisfied, and in some cases the relation of cause and effect may not be apparent to him, so he may wrongfully lay the blame on the contractor who did the wiring or furnished the appliances. Likewise, if the contractor has not rendered good service in properly wiring the premises or in the appliances furnished, the central station may get the blame. In either case the use of electricity may be discredited, which is to be regretted by both of us.

Our mutual interest is, that the home, the shop, the store and all the other places where men work, or play, or rest, shall be supplied with electric service and the conveniences that go with it. But here is only the beginning, for continuing from the first installation the customer will constantly require not only the daily service of electric current from the

Members and Guests at California State Electrical Contractors' Convention.

central station, but very frequent service from the contractor in the way of appliances, extensions in one way and another, and his supply of those things that are consumed in use.

Another mutual interest is that the customer shall have an efficient installation, that he shall get a maximum of result from the current he uses, and a maximum of convenience from the appliances he secures. Unfortunately the ordinary customer has to be constantly educated, and in fact, sometimes fairly coaxed, to realize that improved appliances are an economy to him. Then there is another class that will obtain an appliance, and when some small matter goes wrong with it will lay it aside and return to an old method. How many times we have all known a flat iron to be condemned because of worn contacts in the attaching plug, or a broken strand in the cord.

The greatest correspondence school of education in this country, and that means the greatest in the world, found early in its history that many persons would carry the course along one or two lessons and then quit. This condition became so serious as to threaten the success of the business, and so the plan was adopted of seeking out the faint-hearted ones and helping them over the rough spots; and this is what you must do, and we must do, with our customers. In fact, it is to our mutual interest to join together in a constant effort to see that our customers get the full service they should, in every respect.

In the East you constantly hear of house-wiring campaigns, and especial inducements are offered by central stations for the wiring of old houses. In this territory there is nothing of this kind, due to the fact that the old houses were all wired long ago, and the electrical contractors see to it that the new ones are wired as they go up. So this house-wiring matter is one that the central station manager out here does not have to worry about, and I for one give full credit to the electrical contractor for this happy result.

We also have a mutual interest in educating the public, by disabusing his mind of the many ideas resulting from ignorance or carelessness of thought. We don't have to tell people what electricity is, but what it will do, and how it may be used to save time, to save trouble, and to smooth away many of the difficulties and inconveniences of life.

Before I close, I want to call attention to one thing in which we can co-operate and which it is to our mutual advantage to do so in the education of the public. At the time of my earlier recollections there was no electric wiring, and gas was quite rare except in the heart of the larger cities. In that day if there was a fire and the cause was not definitely known, the paper usually attributed it to a "defective flue," but if it was in summer when stoves were only used for cooking, they would sometimes say the fire was probably caused by "rats gnawing matches." Now-a-days these old causes have fallen into disuse, and in almost every case the cause is given as defective electric wiring. I think electrical contractors can see where it is to our mutual advantage to oppose the indiscriminate blaming of fires on to the electric wiring. Spontaneous combustion is little believed in and seldom mentioned, and many other equally probable causes of fire are neglected, but to me it seems only just that the electric wiring be not condemned until it is proven guilty, and I hope you will all work to thie end.

In the foregoing I have tried to express the thought that the Mutuality of Interest between us is in Co-operation, to the end that the best of service may be rendered by us to the public, and that the best service includes the education of our customers to their advantage, and a reasonable watch over their needs and uses of what we have to offer. Modern practice in the serving of electricity, and the installation of lighting, power, and heating equipment, has become so standardized that there is little occasion for any differences to arise, but there is a refinement of service that can be realized by co-operation which will produce a harmonious result highly beneficial to us all.

THE RELATION BETWEEN THE ARCHITECT AND THE CONTRACTOR.

BY JOHN C. AUSTIN.

The relations that existed between an architect and an electrical contractor a few years back were very unsatisfactory for several reasons—the first being that most architects did not know the rudiments of electricity, and as a consequence had to rely on the knowledge of the electrical contractor, and generally the one who submitted the lowest bid (owners seldom accept any other). The man submitting the lowest bid is not always an embryonic Edison; very often he is a financial fool who has simply counted up the number of outlets, and guessed what it would cost to give a result that would pass the inspection of the architect (who was, as I said before, densely ignorant of the subject) for the smallest amount possible.

After the contract was awarded and the work was started, the contractor's assumed profits began to look microscopically small, so he would then invade some kindergarten and employ labor from that source. He would watch these students work (somewhat as Tom Sawyer watched his playmates paint the fence), and then when it was done, he would apply for his certificate. The architect would then inspect the work, make a few kicks for form's sake, and then issue the certificate; saying that the work was all right, but not saying anything about the beneficent Providence who in most cases looked over it all and gave both architect and contractor the benefit of the doubt.

Another cause of trouble was the practice pursued by some architects of letting the contract for electric wiring to a general contractor, who would then have to sub-let the wiring and other electrical work to an electrical contractor. The general contractor would always feel bound to let the electrical work to the man who could string the most wire for the least money; this, on the face of it, was a poor method as money was the one gauge by which everything else was measured.

It is obvious that an architect cannot master every branch of electricity any more than he can master all of the technical details of plumbing, painting, stone-masonry, and the numerous other items which are necessary to complete the modern building. The wise architect (and he is generally over thirty) when

he has an important building to undertake, will consult with experts in every important branch, and in so doing he will get in touch with the latest appliances and will have a specification that, when it is read, will not bring a smile to the face of the one who knows. It goes without saying, that a carefully prepared set of plans and specifications in which nothing is left to the imagination will give the owner what he wants at a reasonable figure and the contractor will be able to figure a profit.

The demands for electrical apparatus are so numerous and important that the work of an electrical contractor should be independent of that of the general contractor, and he should be treated as an original contractor instead of as a sub-contractor. When an architect lets all of his so-called sub-contracts to what is known as a general contractor, he is simply trying to save trouble to himself; and in saving himself the immediate trouble, he is not conserving the interests of his employer (the owner), but is breeding trouble and consequent dissatisfaction for every one concerned.

The general contractor knows nothing about electricity; then why should he be employed, and why should the owner pay a double profit? By a double profit, I mean profit for the electrical sub-contractor and the other profit being for the general contractor who is supposed to shoulder all responsibility, which responsibility generally consists in figuring a large amount for the wiring and sub-letting it for the smallest amount possible without reference to quality.

Since the electrical contractor has assumed such importance, and since there is in every town an association of master electricians, I think it would be a wise move for each association to have a committee of experts upon whom the architects could call for advice. In the event of trouble and dispute this committee could be called upon to state in an impartial way whether the electrical contractor had fulfilled honorably and fairly the terms of the contract, or whether he had slighted the work. This committee should be composed of men who would render a decision without fear of their colleagues or of the architect.

In the event of the committee finding that the electrical contractor was doing "shoddy" work, then this contractor should be punished, and possibly expelled from the association. When the architects found that the association stood only for straight, honorable, and efficient work, and that the dishonest practitioner would have no place in its ranks; then a membership in such an association would be of great value to its members, and one would think seriously before venturing on transgressing its rules.

I know that it might be said that there would be collusion between the members; but if there was collusion, it would soon leak out, and the association would have done more damage to the cause of uplifting the business of electrical contractors than the few dollars gained by collusion could do good; and the association would soon be a thing of the past.

In a large city this organization could save vast amounts in the following way: Almost every manufacturer sends out samples of the goods he has to sell to the architects, who in a great many cases promptly lose them; and when they find them again, wonder what on earth they are for, as the literature that came with the samples has been relegated to the wastebasket.

If the association could arrange to receive samples and to classify them, the architects would get into the habit of visiting its headquarters from time to time for the purpose of education. Usually the "drummer" manages to call when the architect is immersed in something else; and while the goods that he represents will be of the utmost importance at some future time, the matter is pushed aside for the more pressing needs of the present. If samples of all electrical appliances were filed at the headquarters of the association after the architects had seen them, they would then go there for full particulars when the need became a pressing one.

The manufacturers could pay a small fee for the privilege of filing the samples of their goods with the association; and in doing so they could be sure that their samples were not either stowed away in a cupboard where they could not be found, or lost entirely. These fees could be used to defray the rent and secretary's wages.

The time of the specialist has come in every walk of life, and the expert electrical contractor will have to be recognized as a specialist and as an independent contractor by every architect and owner.

WATER POWER FOR LUMBERING.

A final permit has also been granted to E. P. Ash and Sam Samson of Stevenson, Washington, the power to be used in logging operations in the vicinity of Wind River. The water power project, which utilizes the flow of Wind River, is located entirely on national forest land of the Columbia forest and is about 30 miles northeast of Stevenson. By means of a timber crib dam, about 10 ft. in height, water will be diverted into a wood-stave pipe 4 ft. in diameter, in which it will be conveyed a distance of about one mile to the pressure pipes and the wheels. At the power house there will be installed one 750 kw. unit, direct connected to a Pelton wheel.

HYDRO-ELECTRIC POWER PERMITS.

A water power permit has been granted recently by the secretary of agriculture to the Oro Electric Corporation of California. By this permit the company is allowed to use certain lands of the Plumas national forest, near Oroville, Cal., in the development of hydroelectric power.

Under the permit the power is developed at what is known as the Lime Saddle plant, to which the water is conveyed by means of the Miocene and Nickerson ditches through the Kunkle reservoir. After equalization in this reservoir it is carried to the plant by a pressure pipe about a mile long, where a static head of 478 ft. is obtained. The powerhouse is equipped with two 1000 kilowatt units, driven by two Pelton wheels at a speed of 400 revolutions per minute. At the generators the voltage is 2300, this being increased to 30,000 volts for transmission to the market.

ELECTRICAL PUMPING AND IRRIGATION

APPLICATION OF WATER TO THE LAND.

BY B. A. ETCHEVERRY.

The diversion works, diversion canal, the distribution system and the many irrigation structures which form an irrigation system, are necessary to convey and deliver to the farm or orchard the water necessary to irrigate it. The proper distribution of the water and its application on the farm by the irrigator requires skill and knowledge. Of the water delivered it has been estimated that from 1/3 to 1/2 is lost through evaporation during the application of the water and after, when it passes from the wet soil to the dry air, and from deep percolation beyond the ends of roots. These losses can be largely eliminated by skillful application and thorough cultivation at the right time. The methods of application and distribution will depend much on the value of water, the volume to be handled, the kind of crops and the topography of the land.

The water is conveyed to the different parts of the farm in one of the following forms of conveyor: earth ditches, wooden flumes, concrete flumes, cement pipes, wooden pipes, steel pipes, canvas hose, etc. The water is applied to the soil usually by one of the following methods:

1st. The furrow method. 2d. The flooding method, by overflowing parallel field ditches. 3d. The flooding method by means of basins or checks, which may be either rectangular checks, contour checks, border checks. 4th. The flooding method by using slip joint pipe or canvas hose.

These methods of conveyance and application are well described in a number of bulletins prepared by the Irrigation Investigations of the U. S. Department of Agriculture, a few of these bulletins are:

Farmers' Bulletin 263, Practical Information for Beginners in Irrigation.

Farmers' Bulletin 373, Irrigation of alfalfa.

Farmers' Bulletin 392, Irrigation of sugar beets.

Farmers' Bulletin 399, Irrigation of grain.

Farmers' Bulletin 404, Irrigation of orchards.

Office of Exp. Sta. Bulletin 177, Evaporation losses in Irrigation and Water Requirements of Crops.

O. E. S. Bulletin 203, Distribution of Water in the Soil in Furrow Irrigation.

Separate 495, Soil Mulches for Checking Exaporation.

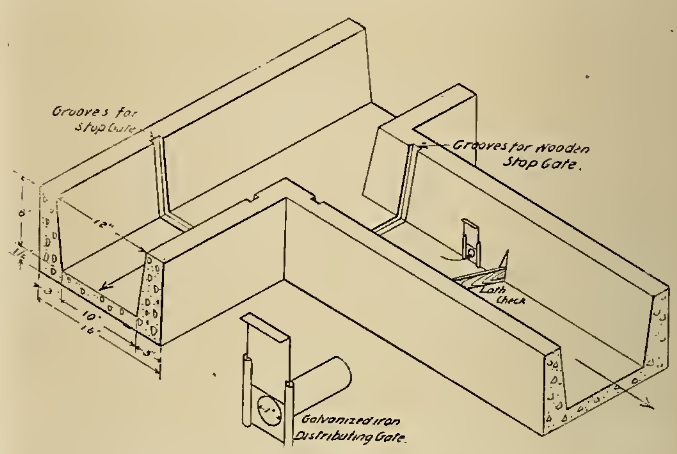
Separate 514, Methods of Applying Water to Crops.

Document 1221, Review of Ten Years Irrigation Investigations.

In Southern California the high value of water has developed skillful and economical methods of distributing water and regulating the flow into furrows. Two methods are largely used, one being the concrete or cement flume distribution system and the other the cement pipe distribution system. The latter is now being adopted in other arid states. These methods are only briefly described in the government bulletins and for this reason a more complete description is given.

Concrete Flume Distribution System.

The leaky earth ditches and the short life of wooden head flumes has led most of the orchardists of Southern California to use either concrete flumes or cement pipes. A concrete head flume is made of the same form as the wooden flume, galvanized iron spouts or tubes from ¾ to 1½ in. in diameter being inserted in the side of the flume before the concrete has hardened, there being one spout for each furrow. On steep slopes, where the velocity is high, to give an even distribution through the spouts, checks made of short pieces of lath are inserted below each opening as shown in the accompanying sketch. To hold the checks in place one end of the lath fits into a groove



Junction of Concrete Distributing Flumes.

cut in the side of the flume by means of a trowel before the concrete is hard. The thickness of the floor for all sizes up to 24 in. in width is 2 in. The side walls for all depths up to 12 in. are 2½ in. thick at the top and 3 in. at the bottom. The flumes are made almost any size. The dimensions and cost of some of the sizes commonly used in Southern California are as follows:

Bottom width inches.	Depth inches.	Cubic feet of concrete per lineal foot of flume.	Cost per lineal foot in inches.
8	11	.54	20
9	12	.60	22
10	12	.63	24
10	14	.66	25
10	16	.69	26
10	18	.71	27
10	20	.74	28
10	22	.77	28½
10	24	.80	29
12	12	.71	25
12	14	.74	26
12	16	.76	27
12	18	.79	28
12	20	.82	29
12	22	.85	29½
12	24	.88	30

The cost of labor and material for which the above costs were obtained are: labor $2 to $2.50 for 9 hours, cement $3.50 a barrel, and gravel $1.50 a cu. yd.

The flumes are constructed on the ground by using a set of forms or moulds into which the concrete is placed. The moulds consist of an inside bottomless trough similar to the form used for lining ditches, but made with the same dimensions as the inside of the flume, and outside walls or sheathing held the proper distance apart from the inside form

by means of spacing blocks and heavy U shaped iron, straddling over the outside wall and inside wall. Instead of the U shaped iron the outside walls could be held in place by stakes driven in the ground. To build the floor and sides at the same time the inside walls are held above the ground by the spacing frames a height equal to the thickness of the floor. The flume is built in sections 12 ft. long, which is the length of the forms. No provision is made for contraction and small shrinkage cracks may occur. These could be eliminated by inserting at the edges a metal tongue 2 or 3 in. wide imbedded about half way into each section. This tongue should be well painted with oil or soap to prevent the adhesion of the concrete and it will then act as a tongue and groove joint.

Concrete Distributing Flume for Orchard Irrigation in Southern California.

To permit the quick removal of the forms, which is necessary unless sufficient forms are used to build a considerable length at one setting, the concrete is mixed comparatively dry and requires careful tamping. A mixture of 1 part of cement to 5 of well graded pit gravel is generally used. It is important that the concrete be kept moist by sprinkling, or otherwise, for a period of at least one week. When completed the side walls are partly backfilled with earth up to about one-half of their height. It is better to have the spouts at least 4 in. long, preferably 6 in. to prevent the washing away of the soil from under the flume, by the action of the water coming out of the spout, which will cause it to settle and crack. These galvanized iron spouts are made by local metal workers at a cost of 4¾ to 5¼ cents each.

A new use for transmission towers has been found by forest rangers who find them helpful as fire lookout stations in the national forests traversed by high tension transmission lines.

Permutit is a compound for softening water which is prepared by smelting aluminum silicates with sodium carbonate and sand. It has the property of exchanging its sodium base for calcium or magnesium, by which means all hardness is removed from the water. Iron manganese and organic matter can also be removed similarly. It can be regenerated indefinitely by passing salt water through a filter made up of this material.

HYDRAULICS. II.

BY OTTO B. GOLDMAN.

The Determination of Stream-Lines (Case 1, Velocity Function Constant.)

To avoid losses because of cross currents and other disturbances in hydraulic apparatus, it is necessary to lay the boundaries along stream lines and further to choose those stream lines that will give the least internal losses. For the best design of such apparatus as the diffuser of a centrifugal pump, or if you please, the water lines of a boat, it becomes necessary to know what the stream lines will be under fixed conditions and further what are the conditions that will give the most efficient stream lines, taking into account the losses due to external and internal friction and other losses, the coefficient of which we may be able to learn from the present state of the art. Theory, sure enough, but the question is simply shall we develop and apply theory to our practice, or shall we wait until the Swiss, for example, have developed and applied it and then manufacture under their patents, paying them a tribute for their greater progressiveness.

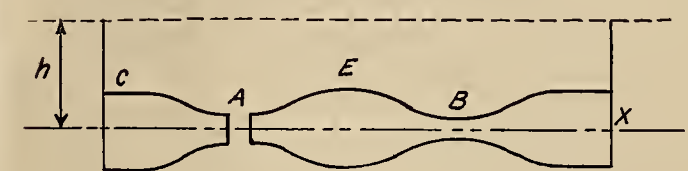


Fig. 1

Referring to Fig. 1, let us take the plane O′ OO″ as horizontal. Since we are dealing with hydraulics, we assume the fluid as incompressible. We shall neglect friction in our preliminary calculations. As ordinates let us choose the distance r along the stream line from its initial point on the line OO′ and the distance S from the axis OO″ measured along a line always at right angles to the stream lines at every point. We will also take first the conditions that V, the velocity, crosses the line OO′ at right angles and is everywhere constant and equal on the line OO′

Taking any element of space dr and ds with velocity V, we can assume V as both a function of r and s, that is

$V = f\,(r, s)$ when r and s are assumed to be independent values. But then

$$\frac{dr}{dt} = \frac{\phi f\,(r, s)}{dr}\,\frac{dr}{dt} + \frac{\phi f\,(r, s)}{ds}\,\frac{ds}{dt}$$

Since we have taken dr along a stream line and ds at right angles to dr, then $\frac{ds}{dt}$ must be zero, and thus V is a function only of r considered as an independent variable and therefore under the initial conditions assumed, V must be constant along an s line

Again the quantity,

$d\,Q = Vds$ ....(1)

and since under the conditions taken V is constant along s, we may integrate at once with respect to s, and therefore

$Q = Vs$ (2) between OO″ and s or $Q' = V\,(s - s_1)$ (3)

between the stream line passing through s_1 and s, where both are measured along the same s line.

Equation (2) gives the quantity flowing between OO″ and any streamline. Q is constant for any s sections taken between OO″ and the given streamline and thus

$Q = Vs =$ a constant is the equation of a stream line.

If the equation of one boundary is $r_0 = f(s_0)$ . . (4) we get

$$Q_0 = Vs_0 \quad \ldots\ldots (5)$$

When Q_0 is the total quantity flowing, and thus

$$V = \frac{Q_0}{S_0} = \frac{Q}{S} \quad \ldots\ldots (6)$$

The kinetic pressure,

$$P_r = W\left(H - \frac{V^2}{2g}\right) \quad \ldots\ldots (7)$$

And substituting

$$P_r = W\left(H - \frac{Q_0^2}{2g\, s_0}\right) = W\left(H - \frac{Q^2}{2g\, s^2}\right)$$

$$= W\left(H - \frac{Q_0^2 K^2}{2g\, s^2}\right) \quad \ldots\ldots (8)$$

$$\text{Where } K = \frac{Q}{Q_0} = \frac{s}{s_0} \quad \ldots\ldots (9)$$

H is constant and equal to $\frac{p_0}{W} + \frac{V_0^2}{2g}$ where p_0 and V_0 are the pressure and velocity at the initial point. We are taking the boundary line $r_0 = f(s_0)$ as stationary, so that all stream lines are fixed in space; later we shall take the more general case of movable stream lines, under these conditions the normal force which is

$$dP_n = \frac{W}{g}\,\frac{V^2}{p}\, ds \quad \ldots\ldots (10)$$

does no work. In the above equation γ denotes the radius of curvature at the point taken.

Referring now to Fig (2) where $\alpha\beta$ is again a stream line, and (s) and (s + ds) an adjacent S—lines, we must have

$$Q = Vs = (s + ds)\,(V - dV) \quad \ldots\ldots (11)$$

and therefore,

$$\frac{ds}{s} = \frac{dV}{V} \quad \ldots\ldots (12)$$

and at the boundary

$$\frac{ds_0}{s_0} = \frac{dV}{V} \quad \ldots\ldots (13)$$

and thus again

$$s = K\, s_0 \quad \ldots\ldots (14)$$

If at the initial point $s_0 = a$, $s = b$, then

$$K = \frac{b}{a} \quad \ldots\ldots (15)$$

Whence

$$s_0 = \frac{s}{K} \quad \ldots\ldots (16)$$

and substituting in equation (4)

$$r_0 = f\left(\frac{s}{K}\right) \quad \ldots\ldots (17)$$

Whence

$$\frac{dr_0}{dt} = f'\left(\frac{s}{K}\right)\frac{ds}{dt} \quad \ldots\ldots (18)$$

and since

$$\frac{dr_0}{dt} = \frac{dr}{dt} \text{ on the same s — line} \quad \ldots\ldots (19)$$

$$\frac{dr}{dt} = f'\left(\frac{s}{K}\right)\frac{ds}{dt} \quad \ldots\ldots (20)$$

$$\text{or } r = f\left(\frac{s}{K}\right) = r_0 = f(s_0) \quad \ldots\ldots (21)$$

The condition K = constant determines a stream line and therefor

$r = f\left(\frac{s}{K}\right)$ with K = any constant is the general equation of a stream line. Thus we see that given one boundary, if the other boundary is also to be on a stream line, the condition of maximum efficiency, its position for any given Q, is at once entirely determined.

The boundary curve is given when $K = 1$.

By equation (21) we see at once that under the conditions taken, the distance a particle travels from any given s — line, is independent of the particular stream line it travels in.

Since $\frac{dr}{dt}$ is the tangential acceleration and $\frac{V^2}{\gamma}$ the normal acceleration we have

$$\frac{\dfrac{d^2r}{dt^2}}{\dfrac{d^2s}{dt^2}} = \frac{\dfrac{dV}{dt}}{\dfrac{V^2}{p}}$$

And therefore

$$p = \gamma\,\frac{V^2}{\dfrac{d^2s}{dt^2}} \quad \ldots\ldots (22)$$

And since

$$S = Ks_0$$

$$Q = KQ_0 \quad \ldots\ldots (23)$$

Therefore,

$$Vs = KQ_0$$

$$\text{or } V = \frac{dr}{dt} = \frac{KQ_0}{s} \quad \ldots\ldots (24)$$

Where Q_0 is an absolute constant and K a variable constant, which becomes absolutely constant only along a stream line.

By equations (20) and (24) we get

$$\frac{dr}{dt} = f^1\left(\frac{s}{K}\right)\frac{ds}{dt} = \frac{KQ_0}{S}$$

$$\text{or } \frac{ds}{dt} = \frac{KQ^2}{sf_1^a\left(\frac{s}{K}\right)} \quad \ldots\ldots (25)$$

Whence

$$\frac{d^2s}{dt^2} = -K^2Q_0^2 \frac{\left[sf^{11}\left(\frac{s}{K}\right) + f^1\left(\frac{s}{K}\right)\right]}{s^3\left[f^1\left(\frac{s}{K}\right)\right]^3} \quad (26)$$

Substituting this in equation (22) then

$$p = \frac{s\left[f^1\left(\frac{s}{K}\right)\right]^3}{\left[sf^{11}\left(\frac{s}{K}\right) + f^1\left(\frac{s}{K}\right)\right]} \quad \ldots\ldots (27)$$

And since

$$dP_0 = \frac{W}{g}\frac{d^2s}{dt^2}ds$$

We get

$$dP_0 = -\frac{WK^2Q_0^2}{g} \frac{\left[(s)f^{11}\left(\frac{s}{K}\right) + f^1\left(\frac{s}{K}\right)\right]ds}{s^3\left[f^1\left(\frac{s}{K}\right)\right]^3} \quad (28)$$

which gives when integrated along a streamline,

$$P_0 = -\frac{WK^2Q_0^2}{2gs^2\left[f^1\left(\frac{s}{K}\right)\right]^2} + \text{a constant} \quad \ldots (29)$$

And if we have $P_0 = O$ when $s = b$, then

$$P_0 = \frac{WK^2Q_0^2}{2g}\left(\frac{1}{f^2\left[f^1\left(\frac{b}{K}\right)\right]} - \frac{1}{s^2\left[f^1\left(\frac{\ }{K}\right)\right]^2}\right)$$

We may here note again that a, W, Q_0 and g are absolute constants, K a variable constant, each value of which determines a stream line, and s a dependent variable, and r an independent variable.

Before proceeding further with our calculations let us examine the condition where s = constant defines a streamline. But we have already found that Vs = constant defines a streamline, therefore V must remain constant, and we also have γ = constant. We thus have the conditions of a liquid passing in a circular bend, or elbow, the liquid entering the elbow at uniform velocity across the section. Whence

$$s_1\omega_1 = (s + ds)\,\omega_2 \quad \ldots\ldots (31)$$

and the amount of sliding of one streamline on another

$$d' = ds\,\omega\,dt \quad \ldots\ldots (32)$$

$$= \frac{ds\,dr}{s}$$

And if the —coefficient internal friction is ϕ, then the power loss in turning the angle θ is

$$L = \iint \phi\, dA\, \theta\, ds$$

$$= f\phi\theta^2 s\,ds \text{ per unit depth}$$

$$= \phi\,\theta^2\,(s_2^2 - s_1^2)$$

Assuming ϕ as constant.

$$\text{If } \theta = \frac{\pi}{2}$$

then

$$L = \phi\frac{\pi^2}{4}(s_2^2 - s_1^2)$$

Consider now the streamline on the outer boundary, you will note that the internal friction force acts in the direction of the velocity while the external friction force acts oppositely. We will thus have an additional loss due to the formation of vorticii.

The application of these calculations to specific examples, and the extension of these calculations to that of variable velocities along the s — lines, the inclusion of the effects of external and internal friction, and vocticii, and the general condition of movable streamlines will be left for future articles.

An electric shock without actual contact with the wire is possible at high voltages. The striking distance is dependent upon the surface, shape and material, being ½ in. for 11,000 volts and 4.65 in. for 60,000 volts between needle points. For a lineman to approach within such a distance, however, is the height of rashness.

The commercial production of artificial diamonds is improbable in the light of our present knowledge. Moissan's process of suddenly cooling a molten mass of carbon-saturated iron gives only the most minute specimens, and in order to obtain crystals of any size it is necessary to maintain a high temperature and a high pressure long enough for liquid carbon to separate from its matrix without contact with the air. Carbon combines rapidly with oxygen at high temperatures, and passes directly from the solid to the gaseous state under ordinary atmospheric conditions.

PERSONNEL OF PUBLIC SERVICE COMMISSIONS.

BY GEO L. MYERS.

Regulation is no longer a subject of contention between party leaders or political parties, if it really ever was, and it is not, in any sense, a partisan question. It is only a political issue in relation to the so-called "trust problem," or in its proposed application to industrial corporations. The progressive party accepts monopoly in the field of industry and endorses regulation,the Democratic party positively refuses to do so, contending that competition should do the regulating. In its relation to public service corporations it is a question concerning which practically all people take common ground. Our changed social and economic conditions made it necessary, together with a growing recognition of the principle that public utilities are natural monopolies possessed of large powers, existent and potential. However, if regulation is to be successful we must have the right kind of regulation, regulation that is fair to the public and fair to the public service corporations.

Much study and consideration has been given to the provisions of public utility laws in order to insure effective regulation and too little study and consideration to the personnel of public utility commissions. The kind of regulation that is to be had is entirely dependent upon the efficiency of the commissioners who do the regulating. If there is not an efficient and competent commission there cannot be efficient and proper regulation. The personal equation is all important and of the utmost concern to both the public and the public utility corporations.

A public utility commission is essentially an administrative and quasi-judicial body in which is vested vast powers of regulation and control, even to the extent of exercising close supervision and direction of the affairs of public service corporations. Control without responsibility is inconsistent. Therefore it is necessary that men possessed of a sense of responsibility comprise the commission, men who can be fair and just to the corporations as well as to the public and impartial and unbiased in their attitude and capable of judging of the merits and facts involved in cases with which they have to deal.

As conditions exist, politics have too much influence in the make-up of commissions. A commissioner is often appointed as a regard for political services rendered the appointive power or because of his political affiliations. Again, in some cases geographical considerations enter into the selection of a commissioner. Sometimes he is appointed to strengthen the chief executive in a given locality, or because of other local considerations, or elected by districts so as to insure district representation on the commission. This is often conducive to the selection of commissioners who are apt to be unfit or to the elimination of men better qualified. The commission is not of local concern, but it is of state-wide concern, and its personnel should not be based upon district representation, and any man appointed or elected should be considered sufficiently broad-gauged and liberal minded to give due and impartial consideration to the entire state in the performance of his duties. Neither politics nor geographical considerations should govern, only ability qualifications and experience. If political considerations make possible his appointment or election such considerations are very likely to govern his conduct as a commissioner. Thus in playing politics he is liable to be unjust to either the public or the public service corporations. No good reasons can be given for politics having anything to do with his selection. Certainly it will not make him more efficient and faithful, and no political principles or issues are to be advanced or sustained. His function is merely to administer the law as enacted regarding public service companies, and it makes no difference what the provisions of the law are, they must be carried out and enforced regardless of the commissioner's political affiliations, and he should not be influenced because of political ambitions or petty partisanship in issuing an order, establishing a rule or rendering a decision. The commission should not be a political clearing house. If it is the public service corporations are going to be the goat and they cannot labor under disadvantages or be subject to unjust burdens without the public suffering with them in consequence, and the only one who will not suffer will be the commissioner who profits because of having used his office for political purposes. Politics do not aid, but actually prevent impartial action, and it is positively necessary that the commission be non-partisan if the best kind of service is to be rendered.

Furthermore, under our present method of choosing commissioners there is a lack of permanency because of politics. If one party is shorn of power and superseded by another, it generally results in a change of a commissioner or two, and in some cases, a change in the entire personnel of the commission, and especially if it is appointive. Thus a man scarcely becomes familiar with the duties of his office, conversant with the public utility laws and educated in the regulation of public utility corporations before he is deprived of office, not necessarily because he is incompetent and inefficient, but due to his not being affiliated with the party in power. Why should the commission be used to educate a man to intelligently perform the duties of his office and enlighten him as to the fundamentals governing public utility regulation and then summarily dismiss him because of his political convictions? Such a condition is ridiculous and absurd. It results detrimentally to the public and the public utility corporations and it is impossible to get down to a satisfactory basis of regulation before another change ensues. If a person were placed at the head of a large public utility or industrial corporation and discharged when he had become familiar with the duties of his office and efficient in performing them and such policy were continued, it would not be long before the organization would become helplessly disorganized and in exceedingly straitened circumstances. The time has come when the people are demanding more in the way of service and that is why they should select the commissioners and do so in such a manner as to leave out of consideration entirely any question of politics as they are now doing in numerous municipalities under commission government, which has proved so

eminently satisfactory that resort has never been had in a single instance to the old political and ward system.

The Interstate Commerce Commission is a success and has the confidence of the public because it is non-partisan in character, composed of men of ability, capacity, knowledge and experience, and is subject to few changes in its personnel. There have been few changes since its inception and since its membership was enlarged. No public body has more difficult duties to perform and none performs them with a greater sense of responsibility to the public and with more regard for the interests of the common carriers. The national commission itself is a powerful argument for non-partisan state commissions.

We are never going to get the right kind of results through regulation unless we give regulation an opportunity to demonstrate and prove its effectiveness and get it down to a fair, business-like and scientific basis so that all parties concerned can get intelligent, just and impartial consideration by a commission of experience and learning having due regard for the rights of the public and a comprehension of the conditions under which a public utility corporation operates.

Mention has been made of a condition. If there is opportunity for improvement or an undesirable condition to be rectified, the question naturally arises as to what is the remedy.

1. The commission should be elected at large by all the qualified voters of the state. This will eliminate appointment by the governor or election by districts.

2. The election should be strictly non-partisan and no party or other political designation should appear on the ballot after a candidate's name. In a good many of the states judicial officers are selected in a non-partisan manner and it would seem better if the name of the candidate for commissioner could appear on a separate ballot along with those of candidates for judicial offices.

3. The election of no more than one or two commissioners biennially.

4. The preferential system of voting should be adopted. This for the reason that it makes possible the selection of a candidate by a majority vote and tends to eliminate the possibility of the election of a candidate who may be unfit, but who has a large personal following. It has a tendency to make the electorate more non-partisan and discriminating in its selection and more probable the selection of a candidate better qualified and more capable. In instances where the preferential system does not meet with approval the non-partisan elimination primary system should be adopted.

5. The recall should be effective in all cases, more especially where the term is for a period of four or six years. This will be the answer to the opponents of the long term because it will make possible the retirement of an obnoxious commissioner at any time.

6. The term of a commissioner should be six years. This makes it possible for him to become reasonably familiar with the public utility laws and the problems affecting regulation. In most of the states the commission consists of three members. This would make necessary the election of only one commissioner at an election. In no state is the membership more than twice the number of years of such a term, thus making it necessary to elect at one time no more than two commissioners.

7. The payment of an adequate salary so that the best services can be obtained and experienced, learned and capable men induced to become candidates. Too often the services demanded and required of a particular officer are totally out of proportion to the salary paid by the state and prevent the acceptance of office by men who are practical and experienced and who have been successful and have a proper conception of business methods and administration.

It would be impractical and undesirable to apply civil service rules and regulations because of the nature of the duties performed by a commissioner, but the method of selection should be such that his tenure of office would depend upon merit and service rendered.

In any event the chief executive should not be vested with the power of appointment. If he is, the appointment will be determined by politics and the commission's personnel at all times uncertain and changing. If it is not as a reward for political services rendered it will be because of the appointee's political affiliations, and regardless of how well qualified the incumbent may be by reason of ability and experience he will be unlikely to retain his office. Again, as previously mentioned, the appointment is liable to be made as a means of strengthening the appointive power or more firmly assuring his tenure of office. The method of appointment would be preferable if it were not for the fact that there is so much politics connected with it.

The unfortunate feature of regulation as it exists at the present time is the probability under our present methods of commissioners being chosen who are totally unfit and absolutely unqualified to serve and who are unfamiliar with the intricacies and problems involved in the regulation of public service corporations.

The pointing out of a condition and the suggestion of a possible remedy should not be construed as a reflection on any commission. No doubt a majority of the commissions consist of men of ability, learning and experience and men who are fair and reasonable, or at least endeavor to be so. However, there should be an effort at all times to eliminate from the blighting influence of partisan politics all public offices that have to do principally with the administration or interpretation of the laws. Of course, there are exceptions, but there are none as to the judiciary. The exceptions exist where the functions of the office have a close relationship with the recommendation or disapproval of legislation, or where there is involved in the selection of a public officer the advocacy and enunciation of certain principles and the adoption of definite policies affecting state government, as, for instance, the governorship of a state. It is even beginning to be questioned and doubted by many citizens that it is necessary that we concern ourselves at all with partisan politics in the government of a state, as is evinced by the agitation for the application to state government of the commission form.

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POWER AND GAS

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CONTENTS

The Induction Generator

When an induction motor is driven above the speed of synchronism by means of some prime mover it acts as a generator and returns power to the line. Such action for instance, may take place with the three-phase motors on the electric locomotives in the Cascade electrification of the Great Northern Railway, when a train is running down hill at high speed. The motor then becomes a generator in accordance with the general rule of the reversibility of dynamo electric machinery. While this fact has long been known its commercial application has lain dormant until sufficient need developed for the use of induction generators. As they are much less affected by speed variations they are particularly well adapted to be driven by gas engines. Furthermore they may be used to correct some of the troubles due to the tandem operation of alternating current generators on an alternating current system.

A crude conception of the conditions existing in such a system may be gained by comparing it with one of the 20-mule borax teams which an enterprising manufacturer has made familiar to all. Assume that the mules are the generators and the wagons the load, which varies with the grade; let the speed of the team correspond to the voltage of the system and its pulling ability to the current; let the leading wattless current be represented by the activity of the leaders and the lagging wattless component by the inertness of the wheelers.

The freighter with his jerk line controls his leaders just as a governor adjusts the synchronous generator to load variations. These leaders are the most active animals in the team and stir up their more sluggish followers, especially the wheelers. Incidentally they would be just as well adapted to haul a light buggy as to be driven in tandem with a heavy team. Yet if they come to a sudden steep hill they are not good pullers but commence see-sawing back and forth and may lose the load entirely, while on the down grade they are likely to run away and wreck the outfit. They require some steadying and soothing influence, something that will pull harder on the up-grade and hold back on the down. This is provided by the wheelers, who work well in tandem but are too slow and lazy to be driven alone, being mere machines giving power to the team but having nothing to do with its rate of travel.

By imagining that synchronous generators are the leaders and induction generators the wheelers the reader should be able to get a mental picture of the functions of these two types of machines. The induction generator gives current only when connected to a system containing synchronous machines and it has no independent voltage. It merely feeds power into the system and does not participate in the voltage regulation. The synchronous generator gives almost unlimited current on a short circuit, cor-

responding to the leaders on a down grade, but the induction generator ceases to generate when short circuited. Synchronous generators supply both wattless and power current, while the induction machine supplies only power current.

Together they make a good team, one reinforcing the weakness of the other. The induction generator is becoming of industrial importance, the most notable installation being four 7500 kw. units installed in the power plant of the Interborough Rapid Transit Company of New York City. Others are contemplated in the near future, the application being made as the need develops.

Exploiting the Public Needs

Municipal ownership of electric power plants is being carefully investigated in every State from the Rockies to the Coast. So many cities and towns are considering this step that it cannot be regarded as endemic, or peculiar to any one locality and dependent upon local conditions. Whatever may be the causes of which this agitation is the effect, they are certainly widespread and deep-rooted. The seeds of public dissatisfaction with private ownership of public utilities were planted years ago by the men whose successors are now reaping the whirlwind. Before the public will heed the warnings as to the dangers of municipal ownership, their minds must be disabused of the past evils of private ownership.

Of these the greatest has been the exploitation of the public's needs. Instead of being served they were often utilized for selfish purposes. If a franchise which was originally granted to meet the pressing demands for service to consumers is made the basis for increased capitalization, if the immediate needs of a community are supplied at exorbitant rates, if public officials are bribed, juries "fixed" or elections manipulated by corporation influence, a public utility becomes a private utilization. To advocate an "open town" in order that "owl" cars may prove profitable or that electric light and power may be used all night, is not in accord with the general public welfare. Such practices cannot but bring a company into disrepute and lay the foundation for future trouble. The public's needs should be served, not exploited.

We well understand that the public service corporation has usually been an unwilling party to such corruptions and has been "held up" by predatory politicians, who are the real root of the evil. It is hoped that by transferring the regulative and rate-making powers to State commissions much of this local exploitation of the public's needs can be obviated. Such commissions have now been established in every State except Utah and Delaware, and in the future should be strong factors in re-establishing public confidence in public utility corporations. Likewise in subjecting municipal projects to the same regulation the public's interests can be adequately protected.

Progress of Hydroelectric Design

Great changes have taken place in the design and construction of hydroelectric power plants since the pioneer developments were made on the Pacific Coast about ten years ago. These changes have all tended towards permanency and efficiency, so that the new model plants should last longer and accomplish more than their protoypes.

One great improvement has been the growing tendency to regard the central station as an integral part of the network instead of as an isolated building whose design and construction is not related to that of any other part of the system. This has been made possible by the development of remote control apparatus, which makes for a simplicity in operation and an approach to that ideal of being fool-proof hitherto unattainable. The higher voltages, also, have increased the size of the buildings so as to accommodate the wealth of high-tension apparatus which has been developed to meet these requirements. The transformer and switching apparatus of a modern plant occupies fully as much space as the generating machinery, which has been subjected to a corresponding reduction in size and weight due to greater refinements in design. A modern generator capable of developing 10,000 kw. is only about three times as large and heavy as the old 1000 kw. machine. Improved ventilation has been an important contributing factor in this evolution.

But even paramount to increased efficiency is the longer life and the greater insurance for continuity of service resulting from the more permanent construction which has replaced the earlier work. The concrete water conduit and the steel transmission tower is being substituted for the wooden flume and the wooden pole line wherever possible.

The wooden flume and the old earthen ditch were at one time the weakest link in the great chain by which the power of falling water is converted into electric light. Steel pipe lines and concrete-lined ditches, while higher in first cost, are more economical in the end. The water lost by seepage and evaporation alone is often sufficient to develop enough power to warrant the additional investment necessary to prevent it. The cost of generating steam power for the few days that water may not be available because of ditch failure more than compensates for the cost of any precaution which will obviate such a state of affairs.

The advantages of a steel tower line over wooden poles for a long transmission are so obvious as to require little comment. Fewer insulators give less opportunity for current leakage and longer spans greatly reduce construction costs. The longer life of steel coupled with the growing scarcity of poles, make the use of the latter inadvisable except for temporary installations. While many other changes are gradually being made, these in the main constitute the essential features of the past decade's development and point the way for the next few years' progress.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. E. Sanderson, Pacific Coast manager for the Bryant Electric Company, is at Los Angeles.

Frank J. Quinn, Pacific Coast manager Manhattan Electric Supply Company, was at Seattle recently.

J. H. Herr, sales engineer with the Sprague Electric Works at San Francisco, is making a trip throughout the East.

A. E. Rowe, sales manager for the Telephone Electric Equipment Company, San Francisco, spent the week on a business trip to Sacramento and vicinity.

S. L. Nicholson, general sales manager of the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., is in Southern California, en route East.

Chas. H. Pierson, publicity manager of the Southern California Edison Company, Los Angeles, and editor of Current Topics, was a visitor to San Francisco during the past week.

M. F. Steele of the Benjamin Electric Company, San Francisco, is making a business trip to Los Angeles and expects to spend two or three weeks in the southern territory.

M. V. Hunt, with the British Columbia Electric Railway Company, Ltd., at Vancouver, B. C., has been elected to the grade of member in the American Institute of Electrical Engineers.

C. O. Poole, chief engineer for the Southern Sierras Power Company, at Riverside, Cal., has been transferred to the grade of Fellow in the American Institute of Electrical Engineers.

H. E. Smoot, son of Senator Reed Smoot, formerly general manager of the Idaho-Utah Electric Company, is now with the Richfield (Utah) Electric Light & Power Company as manager.

A. W. Q. Birtwell, formerly auditor of the Puget Sound Traction, Light & Power Company and now engaged in manufacturing in Massachusetts, is on the Pacific Coast and is expected in Seattle soon.

J. C. McQuiston, manager of the Westinghouse Department of Publicity, and **C. W. Cope** of the same company, left the first part of the week for Southern California en route to Pittsburgh.

Professor C. C. Thomas of the Johns-Hopkins University and inventor of the Thomas electric gas meter, was a recent visitor in San Francisco, leaving for Pasadena, Cal., where he expects to make a visit with his family.

E. M. Cutting, of the Edison Storage Battery Supply Company, San Francisco, returned to town after an extended trip through Montana and expects to leave shortly for a business trip through the Northwest and British Columbia.

G. L. Barker has accepted a position as assistant manager of Eccles & Smith Company, dealers in electric railway supplies, San Francisco, to succeed **F. F. Bodler**, resigned. Mr. Barker was formerly connected with the San Jose Railway Company, where he won many friends who wish him success in his new position.

H. A. Straus, president of the H. A. Straus Company of Chicago, who handled the engineering for the electrification of the Bamberger line between Salt Lake and Ogden, was a visitor in Salt Lake last week. He was rather reticent as to the purpose of his visit, but stated that Eastern capital are prepared to develop the hydro-carbon deposits in Uintah county. Also that he has several irrigation and water power projects of considerable magnitude under consideration.

C. M. Bliven, agent in charge of the Seattle office, General Electric Company, has left for San Francisco, where he will take up permanent work for the company at that point. **H. E. Plank**, turbine specialist connected with the Portland office of the company, will succeed him at Seattle. The boys of the local office, Western Electric and Pacific States local offices, gave Mr. Bliven a farewell luncheon at the Butler Hotel and presented him with a pair of handsome pipes as a token of esteem.

J. E. Boesch, distributing engineer, British Columbia Electric Railway, Vancouver, B. C.; **R. Cornick**, contracting engineer, Vancouver, B. C.; **Glendower Dunbar**, chief electric engineer and assistant superintendent, city Lighting Department, Seattle, Wash.; **Carl A. Heinze**, assistant electrical engineer, Bureau of Los Angeles Aqueduct, Los Angeles, Cal.; **S. E. Hutton**, consulting engineer (electrical and mechanical) Moscow, Idaho; **H. B. Lynch**, manager electric light plant, Glendale, Cal., and **R. H. Manahan**, city electrician, Los Angeles, Cal., have been transferred to the grade of member in the American Institute of Electrical Engineers.

F. L. Annable, formerly superintendent of the northern division of the Pacific Electric Railway at Los Angeles, has been appointed to the newly-created position of general superintendent in charge of operations. **A. C. Bradley**, superintendent of the San Bernardino division, succeeds Mr. Annable, while **M. P. Groftholdt**, superintendent of the Riverside Division, will have his jurisdiction extended over the San Bernardino Division. This combining of the San Bernardino and Riverside divisions creates a new division to be known as the Eastern Division, with offices at both San Bernardino and Riverside. As a part of the general plan to tighten up the operating system as a result of the general growth of the Pacific Electric, **Edwin Clark**, who has been assistant superintendent of the Northern Division, is transferred to the Western Division in the same capacity, where the constantly increasing beach travel makes increased supervision a necessity. **H. E. Rodenhouse**, a former assistant superintendent for the road, takes Clark's old place on the Northern Division.

H. P. Bubke, substation operator, Spokane & Inland Empire Railroad, Spokane, Wash.; **Paul Bucher**, engineer, Pacific Gas & Electric Company, San Francisco, Cal.; **Fred W. Carlson**, inside installation work, Helena Electric Company, Helena, Mont., **Albert K. Harford**, manager, Municipal Light & Power Company, San Francisco, Cal.; **Laurence G. Hendry**, manager Hendry-Crossman Electric Company, Ltd., Vancouver, B. C.; **Willoughby Jno. Henry**, engineer, Vancouver, B. C.; **Edward Holder**, district representative, sales department, British Columbia Electric Railway Company, Ltd., Vancouver, B. C.; **Hubert D. Long**, Utah Power & Light Company, Salt Lake City, Utah; **C. J. Macke**, electrical engineer, McCleary, Wash.; **Ferdinand C. Miller Jr.**, superintendent of electricity, Powell River Company, Ltd., Powell River, B. C.; **L. J. Pospisil**, engineer in charge of designs, Washington Water Power Company, Spokane, Wash.; **Thos. Anthony Purton**, draughtsman, electrical engineering department, Oregon Short Line Railroad, Salt Lake City, Utah; **Franklin L. Rohrbach**, engineer in charge of underground system, Washington Water Power Company, Spokane, Wash.; **Gavin T. Scouler**, assistant inspector of gas and electricity, Dominion Government, Vancouver, B. C., and **Torsten G. Winter**, engineer, Western Canada Power Company, Vancouver, B. C., have been elected associates in the American Institute of Electrical Engineers.

OBITUARY.

F. V. T. Lee died on August 18th at Victoria, B. C., from pneumonia. His death has come with a suddenness which stuns his many friends throughout the country, particularly as he had but recently renewed many old acquaintances. His interests were so diversified and his attainments were so great that there are but few electrical men to whom he was not known with respect and to whom his passing will not be a distinct loss.

Francis Valentine Toldevy Lee was born at Winchester, England, in 1870, receiving his early education in Europe, but coming to America in 1887. At twenty years of age he entered the employ of the Manhattan Electric Co., becoming assistant to the superintendent, when he realized the necessity for a knowledge of electrical theory three years later. Entering Stanford University in 1893, he graduated in 1896,

F. V. T. Lee.

also being assistant to the late Dr. A. C. Perrine, who at that time was editor of the Journal of Electricity, Power & Gas, as well as professor of electrical engineering.

As an associate of John Martin in the firm of John Martin & Co. (now Pierson, Roeding & Co.), he supplied the equipment for many of the early hydroelectric installations on the Pacific Coast. In 1906 he became assistant to the president of the Pacific Gas & Electric Company, remaining as a stalwart aid during the four years following. He resigned early in 1910 to look after his private interests. He was a member of many engineering societies in this country and abroad, as well as of the Masonic fraternity. He is survived by a wife and two daughters.

This brief record of dates is utterly inadequate to reflect the great living personality of the man behind them. "We live in deeds, not years; in thoughts, not breaths; in feelings, not in figures on the dial." He was a man who made strong friends and kept them because of his sterling qualities. Their one comfort in his untimely death is its merciful ending.

RAILROAD COMMISSION OF OREGON.

At 10:30 a. m. on August 12th representatives of all the various public utilities companies, underwriters, inspectors, etc., met in open conference at Salem. The tentative rules were subjected to a thorough grilling. About the first of the month the commission intends to have the rules in final shape for promulgation.

PROGRAM PACIFIC COAST CONVENTION AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, VANCOUVER, B. C., SEPT. 9, 10, 11.

Tuesday, Sept. 9th.

Morning: Office open for registration.

Opening meeting. Address of welcome by Premier of British Columbia, followed by Paper and discussion: "Snow and Ice Loading on Transmission Lines," V. M. Greisser.

Afternoon: Paper and discussion: "Mountain Railway Electrification," A. H. Babcock.

Automobile and car trips, seeing Vancouver, for the ladies of the party.

Evening: To be left free for theaters and private entertainment.

Wednesday, Sept. 10th.

Morning: Paper and discussion: "The Gulf of Georgia Submarine Telephone Cable," E. P. LaBelle and L. P. Crim.

Afternoon: Paper and discussion: "A Modern Substation in the Coeur d'Alene Mining District," J. B. Fisken.

Automobile drive to Capilano Canyon for the ladies.

Evening: Illustrated Lecture.

Thursday, Sept. 11th.

Morning: Paper and discussion: "Logging by Electricity," E. J. Barry.

Afternoon: Paper and discussion: "High-Voltage Circuit Breakers," K. C. Randall.

Automobile drive for the ladies around Stanley Park and Marine Drive, followed by tea party.

Evening: Banquet.

Friday, Sept. 12th.

Rail and Lake Excursion to New Generating Station of the Western Canada Power Company, at Stave Falls.

Saturday, Sept. 13th.

Boat Excursion to New Generating Station of the B. C. Electric Railway Company at Lake Buntzen.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Great Western Power Company has applied to the railroad commission for a modification of the order made by the commission in March, giving the utility permission to issue its first mortgage 5 per cent forty-year sinking fund gold bonds of the par value of $4,411,000. The company now desires to make slight variations in the improvements and extensions to be made from the money derived from the bonds. The company has revised its estimated expenditures, which now take the following form:

Additions and improvements to the distribution system, including pole lines, transformers, regulators, meters, etc., in the counties of Alameda, Contra Costa, Sacramento, Solano, Sonoma and Napa, and in the cities and towns therein; cables under Carquinez straits and the bay of San Francisco, substation at Denverton, additions to substations at Napa and Sacramento, warehouse and garage at Petaluma, equipment of office at Napa, $1,059,040.85.

Additions and improvements to transmission system, including fifteen miles of 100-kilowatt tower line; substation at Antioch, additions to substation at Cowell, Clayton and Brighton, $145,312.

Additions and improvements to the production system, including the completion of the Big Bend development, synchronous condenser at Oakland steam plant, $685,727.

Additions and improvements to the lands appurtenant to the hydroelectric development, including acquisition of lands in Big Meadows, $200,000.

Additions and improvements for general utility purposes, including cable barge, $18,300.

Completion of gravity section type dam at Big Meadows, $1,607,635.

Reimbursement for capital expenditures, $280,783.

The commission has issued an order permitting the Western Electric Company to sell its telephone exchange plants at Portola, Plumas county, to the Pacific Telephone & Telegraph Company for $466.31.

The Ventura County Power Company has been given permission to sell the Oxnard Water Works system to the city of Oxnard for $30,000.

The Pacific Telephone & Telegraph Company has applied for authority to withdraw from the territory at Farmington, and the Farmington Telephone Association has applied for authority to enter this territory.

The Lindsay Home Telephone & Telegraph Company has been authorized to issue 1644 shares of its capital stock of the par value of $1644, said stock to be issued in exchange for property acquired by the company.

The commission has denied the application of the Oro Electric Corporation for a rehearing of the decision of the commission upon the application of that company for permission to serve certain portions of San Joaquin county and the city of Stockton. There is no opinion accompanying the order denying the rehearing.

The commission issued a supplemental order approving a slight alteration in the terms of a general lien mortgage which the Pacific Gas & Electric Company has been permitted to execute to the Guaranty Trust Company of New York and William C. Cox to secure a $5,000,000 issue of 6 per cent ten-year convertible general lien gold bonds. The alteration in the terms of the mortgage permits the individual trustees as well as the corporate trustees to exclude and deliver the bonds.

The commission has rendered a decision permitting the Tulare County Power Company to issue ten promissory notes in the aggregate face value of $50,000, secured by 133 6 per cent bonds of the par value of $66,500. The notes authorized are to replace ten similar notes now held by Thomas C. Job. The commission denied the application of the company to pledge eight of its 6 per cent refunding bonds of the par value of $4000 to secure $3243 interest on the notes held by Job.

ELECTRICAL CONTRACTORS' NOTES.

The Electric Fixture & Supply Company, 117 Marion street, Seattle, has secured an order from the government for installing approximately $400 worth of fixtures in officers' quarters at the navy yard, Bremerton.

J. J. Agutter & Company, Seattle, have secured the contract for general electrical installations in the Ford Motor Car Company plant being constructed there, at $7000.

The Columbia Electric Company, Seattle, is doing the electrical work in the West Woodland school, the Lake school and the J. P. Jones apartment building.

The electrical contract for the new Pacific Telephone & Telegraph Company's new building on the southeast corner of Oak and Park streets, Portland, Oregon, has been let to the Pacific Fire Extinguisher Company. They have also obtained the electrical contract for the new Supreme Court Building in Salem, Oregon.

The electrical contract for the new Troy laundry, located on E. Tenth and E. Pine streets, Portland, Oregon, has been taken over by Fred H. Kaltz, 218 Worcester Building, Portland, Oregon. The Petler Electric Company had this contract but due to Mr. Petler's death the contract has been transferred to Mr. Kaltz. This is to be the finest electrically driven laundry in the northwest.

SEATTLE POWERLESS TO REGULATE UTILITIES.

Judge Frank H. Rudkin of the United States District Court recently held, while sitting at Seattle, that the city exceeded its powers two years ago when it passed an ordinance requiring the Seattle Electric Company, now the local division of the Puget Sound Traction, Light & Power Company, to sell commutation tickets on all street cars operated by it within the city limits. A permanent injunction was granted against the enforcement of the order by the city. At the same time the court held that the act of the state legislature approved March 18, 1911, commonly known as the public service commission law, took away and superseded the power of municipalities of the first class to enact such ordinances. Damages sought by the company at the rate of $5000 per month since the beginning of the suit against the city and amounting to about $100,000 were denied by the court on the ground that the municipality on making its ordinances was exercising a purely governmental function. It is announced that the city will take an appeal to the circuit court of appeals to determine whether the city has been stripped of its power to regulate public utilities.

TRADE NOTES.

James O'Brien, San Francisco, has received the contract for an $80,000 dam for the Yolo Water & Power Company, at Cache Creek, Lake county, Cal. The dam will be 40 ft. high and 200 ft. long across the crest.

The Berkeley Electric Cooker Company, Berkeley, Cal., has received orders for 50 Type C cookers each from the L. C. Converse Company, Denver, Colo., and Norris & Evans, Kansas City, Mo.

Chas. C. Moore & Company, Seattle, have procured the contract for Stirling boilers, piping, heating, etc., to be used in connection with the reconstruction of the steam heating plant of the Missoula Light & Water Company, Missoula, Montana.

The Seattle office of Pierson, Roeding & Company has secured a contract for supplying the city of Kamloops, B. C., with high-tension insulators and pins and steel reinforced aluminum cable for a 43-mile transmission line from the Barriere River to Kamloops.

The Los Angeles Gas & Electric Corporation, Los Angeles, Cal., have bought one 300 kw. motor-generator set consisting of one 250-125-volt, 3-wire, d.c. generator direct-connected to one 2400-volt, 3-phase, 60-cycle, 870 r.p.m. induction motor from the Westinghouse Electric & Manufacturing Company.

The Joshua Hendy Iron Works, San Francisco, shipped last week to the Alaska-Gastineau Mining Company, Juneau, Alaska, a 600 h.p. tangential water wheel to be used in this company's hydroelectric development. One unit will be installed at present but provisions are being made for further development.

The Pacific States Electric Company advise the adoption of Union pressed steel lamp standards by the city of Berkeley, Cal. An installation of electroliers has just been completed on University avenue. The United States Government has also been a recent purchaser of Union metal lamp standards, most notable among the installations being that at Fort Mason, San Francisco.

BOOK REVIEW.

The D'Este Steam Engineers' Manual, with Electrical Appendix. By Charles Penrose; 513 pp.; 5x7½ in.; flexible black leather. Published by Julian D'Este Company, 24 Canal street, Boston, Mass., and for sale by Technical Book Shop, San Francisco. Price $2.00.

This text comprises one of the most practical compendiums on steam and electrical engineering which has been published. It is divided into two sections, a steam and an electrical. The information given is within the comprehension of the steam engineer and should prove invaluable for reference and study. A unique feature in the electrical section is the use of many illustrations of recent types of equipment of various makes. While issued as an advertisement for a number of steam engineering specialties it gives much more for the money than is usually found in a book of this low price.

INDUSTRIAL

A NEW TROLLEY CATCHER.

The Ohio Brass Company of Mansfield, Ohio, is marketing a new trolley catcher. Fig. 2 shows the principal parts of the operating mechanism. Three dogs, mounted on the back of the reel are thrown outward by centrifugal force when the trolley wheel jumps. One dog rides over the guide (A-B) and engages the stop at (B). Under normal conditions, these dogs are held in toward the center by rugged coiled springs

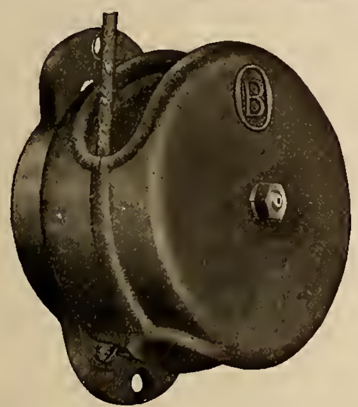


Fig. 1. O-B Trolley Catcher.

which are enameled to prevent rusting. In operation the coiled springs are only slightly extended, insuring long life. The main operating spring is enclosed in the extreme back part of the case.

All parts are made sufficiently rugged to withstand the abuse which such a device usually gets in service. The case is made of malleable iron, enameled. A large opening is provided at the bottom to drain off moisture.

A separate base casting is bolted directly to the car dash and the catcher can be quickly inserted in the base and held

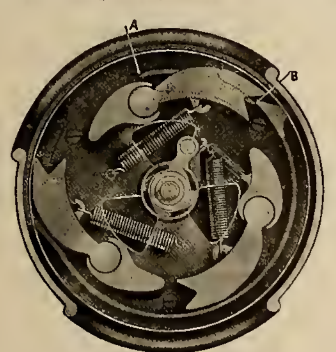


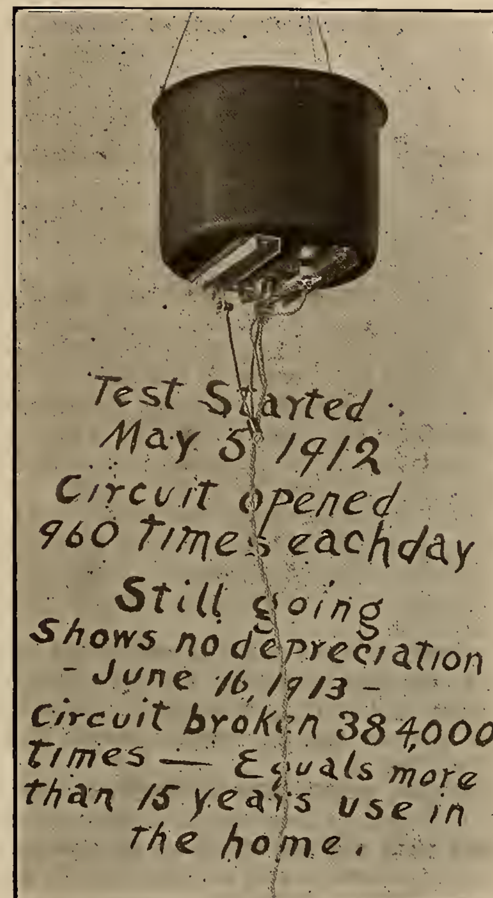
Fig. 2. Phantom View.

in place by a spring operated catch. For double end operation, a base is installed on each end of the car and one catcher used.

One of the aims of the designers was to eliminate stepping up or climbing of the trolley pole after the rebound which follows the sudden stopping of a flying pole. This was accomplished by means of the guide A-B. The dog which engages the stop at (B) rides over this guide and cannot be pulled back toward the center by its spring until the rope has been wound in sufficiently to allow the dog to travel backward on the guide to the point (A). Exhaustive service tests proved that the rebound will never be sufficient to cause this to happen. In other words, when the trolley wheel jumps, the O-B Catcher catches the pole quickly and holds it when caught.

AN INTERESTING TEST.

The accompanying illustration shows a test which is being conducted by the Berkeley Electric Cooker Company, Berkeley, Cal. The test is interesting in that it demonstrates the reliance which can be placed in automatic de-



Test of Circuit Breaker.

vices when properly constructed. The device is used for breaking the circuit on one of this company's electric cookers and at the time the picture was taken had been in continuous operation for over a year. The carbon contacts breaks a five ampere current and although this operation has been repeated almost a half million times the contacts show practically no deterioration.

NEW CATALOGUES.

The General Electric Company has just issued Bulletin No. A4124, devoted to a detailed description of its Automatic Starters for Alternating Current Motors. The bulletin describes automatic control panels for squirrel cage induction motors and slip ring induction motors, float switches for remote control of automatic starting panels or rheostats, and pressure governor panels, also for remote control. Bulletin A4139 is devoted to Central Station Oil Switches of High Rupturing Capacity, both automatic and non-automatic, for voltages from 15,000 to 70,000fl Bulletin No. A4130, describes Adjustable Speed Direct Current Motors for individual drive or machine tools. Bulletin A4093 illustrates and describes Generators for Electrolytic Work.

NEWS NOTES

INCORPORATIONS.

RAYMOND, WASH.—Willapa Electric Company, $400,000, by J. S. Thornton, R. L. Fisher, et al.

BRUNEAU, IDAHO.—Idaho Southern Telephone Company has been organized to construct and operate a system in Owyhee, Ada, Elmore, Twin Falls, Gooding and Canyon counties; $50,000 capital. W. D. Reynolds, C. B. Faraday of Mountain Home, and M. E. Reynolds of Bruneau, are incorporators.

ILLUMINATION.

VANCOUVER, B. C.—Ratepayers' association favor municipal electric light plant.

PORTLAND, ORE.—Commissioner Daly, department of public utilities, is investigating the question of a complete municipal lighting system.

SMITHFIELD, UTAH.—The city council has designated August 29th as the date for special election to vote on the issuance of $25,000 in bonds for the purpose of installing a municipal light and power plant for this city.

GALLUP, N. M.—The Peoples Light & Power Company has been granted a franchise to construct and maintain all necessary appurtenances, for furnishing electricity for light, heat and power purposes to the town of Gallup.

SPOKANE, WASH.—Property owners on Trent avenue between Lincoln and Division have signed petition for electroliers along the avenue. Petitions are being circulated for lights on Main avenue, First avenue, Riverside avenue and Washington street.

LOS ANGELES, CAL.—The city council has abandoned the idea of extending ornamental lighting system on Pico street, because lighting companies refused to lay necessary cables, and it would cost the property owners $1 per foot to make the extension.

BREMERTON, WASH.—The Bremerton city council has passed an ordinance to purchase the Bremerton-Charleston electric light plant and has called for an election for the last Tuesday in August to vote on $90,000 bonds to pay for the plant and $35,000 for extensions.

SALT LAKE CITY, UTAH.—A movement has been started by the Salt Lake Real Estate Association to induce the city to erect a municipal electric light plant in City Creek Canyon to furnish power for the street arc lighting. W. G. Tuttle of the association is backing the movement.

PARK CITY, UTAH.—The city council has granted to L. A. Jeffs and associates of Salt Lake, a franchise to construct and operate an electric light and power system in this city for a period of 25 years. It is promised that construction work on this new plant will be started at an early date.

IDAHO FALLS, IDAHO.—Mayor Clark has returned to the city after a tour of inspection of electric light plants in southern Idaho. The object of the trip was to gain information regarding the creation and sale of electrical energy for heating and cooking purposes. The capacity of the city plant will in all probability be increased.

OGDEN, UTAH.—The Real Estate Association of this city at its meeting on August 13th, adopted a resolution favoring a municipally owned electric light plant for this city and stating that they will oppose for election any candidate for mayor or commissioner, who will not go on record as favoring the construction of such a plant at the earliest possible moment. S. S. Smith, J. J. Brummit and Geo. Kelly were named as a committee to follow up the agitation for a municipal plant to be constructed in connection with the dam in South Fork Canyon now being installed for city water supply.

OAKLAND, CAL.—Two important recommendations are made to Commissioner Turner in a report submitted by City Electrician Babcock, who recommends that the city's system of gas lighting for the streets be extended to all parts of the city which are densely populated; that a luminous type of lamp be substituted for the present arcs and that the city's electrical department be made independent of the power companies. Babcock says: "To make this department independent of the power companies, I recommend that there be installed in the salt water pumping station a direct connected gas engine unit of sufficient capacity to furnish light and power to the fire alarm department and the pumping plant." Babcock also recommends that the fees of the department be increased so as to make the department pay for itself. In his report Babcock says that during the past year there was a 34 per cent increase in the number of box alarms, and one of 26 in telephone alarms. The city now has 340 miles of copper wire installed on branch lines, providing service to 27 fire companies, 231 fire alarm boxes and 155 police boxes.

TRANSMISSION.

BELLINGHAM, WASH.—The committee investigating the establishing of a municipal power plant on the north fork of Nooksack is favorable.

EATONVILLE, WASH.—The proposition to build a municipal power plant of 100 kilowatts capacity on Lynch Creek carried at the election. Evans Dickson Company, Tacoma, are the engineers.

SEATTLE, WASH.—The Cascade Mining Company has water power rights on Miller River at the town of Benton, about 40 miles from Seattle, has offered these rights to Seattle at $90,000. No survey has yet been made showing to what extent the site may be developed. The offer was referred to the public utilities committee of the city council for investigation.

LOS ANGELES, CAL.—Work on the tunnels that will carry the water from behind the 140-foot dam at Big Creek to the 2100 foot drop that leads to power house No. 1 of the Pacific Light & Power Company, has been resumed. The tunnel at Big Creek is 3½ miles in length and is 12 ft. in diameter. From power house No. 1 the water is carried through a series of tunnels and flumes to the drop above power house No. 2.

EUREKA, CAL.—Frank Langford and his son, Carl, have been granted a right of way for their water canals through the forest reserve, at the big bend of the Klamath River. Secretary of the Interior Lane has granted the petition of the Langfords for a right of way through the national forest and they will now immediately proceed with the construction of their electric power plant at Ishi Pishi Falls. The Langfords hold a right of 500,000 inches of water in the Klamath River and can use as much water as possible without interfering with the government reclamation project at Klamath Falls.

SAN FRANCISCO, CAL.—The trustees of the United Properties have signed an option giving R. G. Hanford until January 1, 1914, to sell control of the United Properties to a British syndicate. Both parties to the deal decline to discuss the matter further than to confirm the fact of the option having been given. Hanford has contended all along that an English syndicate stood ready to take over the property and put into it the money necessary to carry out

the projects outlined at the time the United Properties were organized, and it is understood that he will leave at once for London to close the deal. The option covers also the Smith holdings in the United Properties, said to represent $5,000,000 to $6,000,000.

RIVERSIDE, CAL.—A merger of power systems, four in all, which will furnish current for the operation of industries in western Nevada, the eastern portion of California, and a large part of southern California, is announced by Delos Chappell, president of the Southern Sierras Power Company, who has returned from a trip to Inyo county. The territory to be covered by this system extends from a point as far north and east as Round Mountain in Nevada to Riverside and surrounding towns. The various systems will be connected by the building of a line between Bishop and Lundy Lake. The full connection will be effected by the construction of a line from Bishop to Long Valley by the Silver Lake Power & Irrigation Company, and by an extension to be made by the Pacific Power Company from Long Valley to Lundy Lake. The Silver Lake Power Company has power projects on the Owens River, while the Pacific company has its plant on Lundy Lake. The parent company is the Nevada-California Power Company, which gets its current from a chain of five hydro power plants on Bishop Creek, the source of supply also for the Southern Sierras Power Company.

TRANSPORTATION.

MISSOULA, MONT.—A subscription list has been started to secure a trolley line in Rattlesnake district.

ANACORTES, WASH.—A proposed franchise, giving the Anacortes & Eastern Railway the right to construct and operate a standard gauge railway over certain streets of teh city, has been referred to the streets and park committee.

LOS ANGELES, CAL.—The Los Angeles Railway Company is planning to erect a new car house at Washington and Pacific avenues, to care for increased traffic in the south and west sections of the city. The cost will be about $300,000, and construction work is to begin soon as possible. The building will be of steel and concrete.

PRINEVILLE, ORE.—Negotiations have been closed with H. P. Shell, Tacoma, for the construction of an electric line between Metolius, on the Oregon Trunk railroad and this place. The road will be 30 miles long. T. N. Baldwin, First National Bank, and C. M. Elkins, Crook County Bank, are members of the Prineville committee.

EL PASO, TEXAS.—The right to construct three new street car lines in the city of El Paso has been granted to the El Paso Electric Street Railway Company. The proposed tracks will be constructed on Tenth, Piedras and Hague streets and the company is required to begin work on the lines within two months after approval of the ordinance.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company is building ¾ mile of track to connect with the King county industrial district near Georgetown, Washington. This track will be paid for by the county and the first industry to be served will be the Seattle-Astoria Iron Works, a new plant. The Oregon-Washington Railway & Navigation Company is also building considerable track in that neighborhood to connect with the electric line.

OGDEN, UTAH.—The directors of the Ogden Rapid Transit Company have not decided to build the Twenty-seventh street car extension at this time, due largely to the fact that the residents on the avenue between Twenty-fifth and Twenty-seventh streets are opposing the car line there. President M. S. Browning states that the company would have constructed this line before now had it not been for the objections raised by the property owners.

VISALIA, CAL.—The building of the Big Four electric interurban line to connect with Tulare, Visalia, Poplar and Porterville has been officially sanctioned, according to information received here from the State Railroad Commission by Frank Avery, president of the proposed system. Avery declared that construction work will be commenced within ten days and that application for franchises over city streets and local terminals will be made at the next meeting of the council.

SACRAMENTO, CAL.—Two interurban lines now operating into Sacramento—the Northern Electric and Central California Traction Company—are considering the Hanrahan building on the corner of Eighth and L streets, as a possible depot. It is planned to use the ground floor for passenger trains and the upper floor for offices. For some time both railroads have been seeking terminal facilities, as there has been considerable complaint because the cars have stood on Eighth street.

PHOENIX, ARIZ.—The Phoenix Street Railway Company have notified the city council of its refusal to pay its portion of the cost of paving North Second avenue between Washington and Van Buren streets, the petition for which has been made by a majority of the property owners. General Manager Mitchell of the company says that eventually the company will pay its share of the cost of this paving, but it is not convenient to do so at the present time and has decided to leave its tracks as they are. The council has referred the matter to City Attorney J. T. Prescott for advice.

SALT LAKE CITY, UTAH.—S. S. Arentz, chief engineer of the Salt Lake & Ogden Railway Company, the Orem Road, made definite announcement this week that unless unforseen happenings interfered, trains would be running over their lines between Salt Lake and Provo by the first of the year. If this is accomplished, this company will have done a remarkable piece of engineering. With less than three months of construction work past it will require unusual efforts during the remainder of the year to complete the 53 miles of line necessary, including sidings and stretches of double track.

STOCKTON, CAL.—Speaking of the negotiations pending between the Central California Traction line and the Tidewater Southern line by which the latter company plans to operate over the lines of the traction company in order to reach the Stockton waterfront, officials of the Tidewater company emphasize the fact that the negotiations pending in no sense represent a sale of the Stockton-Fresno railroad. The Tidewater Southern has no thought of a sale, but on the other hand are making rapid progress toward getting its road in actual service and hope to have its cars running over Pilgrim street and Weber avenue to the waterfront by October. The real facts of the case are that the Tidewater Southern is being kept out of Stockton by reason of the terms of the city charter.

TELEPHONE AND TELEGRAPH.

ORANGE, CAL.—The city trustees have received communication from the Postal Telegraph Company asking for permission to build lines into Orange along the Pacific Electric right of way, from Santa Ana.

SAN LUIS OBISPO, CAL.—J. H. Verkruzen, right-of-way agent for the Pacific Telephone & Telegraph Company, was here arranging for the removal of all poles from the business section of the city. Work is about to be commenced by a crew of wiremen under the special agent. Agent Verkruzen has secured the right of way and permits from all the property owners in the principal business sections of the city to install conduits, hang cables and install what is known as a "block system." The wires will be removed and overhead lines will only be seen in the outlying districts. Cables containing many wires will be utilized in carrying out the work. These will be hung in the rear of buildings and all telephone connections made either from the rear end of the roof or from the basement.

ALPHABETICAL INDEX TO ADVERTISERS

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

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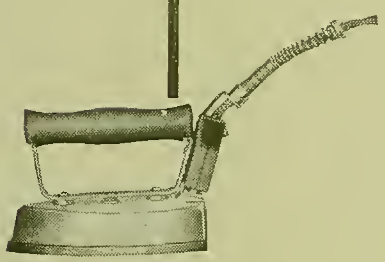

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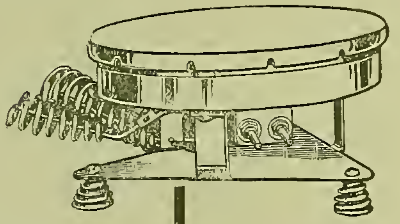

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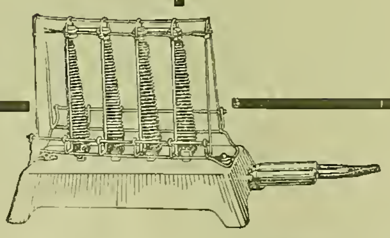
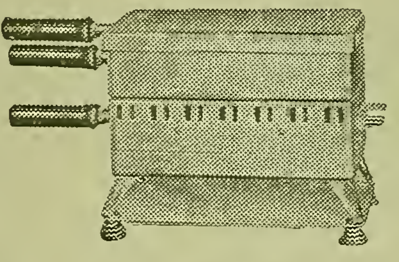


Electric Toaster



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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI SAN FRANCISCO, AUGUST 30, 1913 NUMBER 9

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THE STAVE FALLS POWER PLANT

BY E. R. PEASE.

The Western Canada Power Company, Limited, was formed in 1909 for the express purpose of supplying power for industrial purposes in Vancouver and the vicinity at such rates as to encourage the establishment of factories and in sufficient quantity to meet any demand that the rapid growth of Vancouver may develop.

Stave Falls Power Plant of Western Canada Power Company, Showing Weir and Intake Dam.

In June, 1909, the company took over the property and franchises of the Stave Lake Power Company, Limited, which had secured a charter from the government of the Province of British Columbia giving it the right to develop power on the Stave River, and to distribute power over the whole of the district surrounding Vancouver, and had also secured franchises for the sale of power for industrial purposes in Vancouver and New Westminster.

The Stave Lake Power Company had in the course of several years previous to 1909, done considerable preliminary work at the Stave River, including the establishment of a gauging station, the building of roads and camps, and the partial construction of a log sluice dam.

The Western Canada Power Company, Limited, commenced the construction of a 50,000 h.p. power house in the winter of 1909-1910. The first section of this power house, comprising two units of 10,000 kw. capacity each, was completed and power was delivered in Vancouver on January 1, 1912.

During 1911 and 1912, the company built a distribution system comprising over 150 miles of pole lines and covering practically the entire district from Vancouver eastward along the Fraser Valley for a distance of sixty miles, and as far south as the international boundary.

During this period a large amount of power has been sold to new and existing industries, a contract for the sale of some 6000 h.p. has been entered into with the Puget Sound Traction, Light & Power Company, and a contract for the supply of power increasing in the course of several years from 10,000 to 40,000 h.p. has been made with the British Columbia Electric Railway Company.

After little more than eighteen months of operation the power plant at Stave Falls is loaded to its capacity, orders have been placed for two additional 10,000 kw. units, the work of extending the power house is under way and arrangements have been made to commence the construction of a second power house of equal capacity in 1915, so that the company will have ultimately an output of 100,000 h.p.

The power development is at Stave Falls, about six miles north from the junction of the Stave and Fraser Rivers at Ruskin, B. C., and thirty-five miles east of Vancouver City.

The mountains forming the watershed are granite; they rise high above the timber line, and are covered with snow and small glaciers. The upper river is a large glacier-fed stream, and several smaller streams empty into the lake, some coming direct from the glaciers on the high mountains on the west side of the lake.

Complete Development of Western Canada Power Company.

The lake is nine miles long and about a mile or more wide. The east and west shores are precipitous, but at the head and foot there were large areas of low-lying land, which were flooded during high water. From the foot of the lake to the Stave Falls the river is seven miles long, about two miles of this having been rapids, with a total fall of eleven feet, the rest being navigable at all stages of the river and having practically no fall. At the falls and the rapids, in the immediate vicinity of Stave Falls, the river drops eighty feet, and then continues on its course over a series of rapids for a distance of four miles, finally debouching through a narrow granite gorge into a tidewater basin, where it joins the Fraser River.

The total fall from the original low water level of the lake to tidewater was 225 ft., and when the dam, which has now been constructed, has been increased to its full height, the water will be raised 35 ft. above the low water level.

The dam will form a lake extending from Stave Falls to the upper end of Stave Lake, a distance of 16 miles. The area of the lake at the present height of the dam is about 13 square miles, and when the dam is completed to its full height the area will be 23 square miles. This reservoir will have a storage capacity of 14,000,000,000 cu. ft., which is large enough to store the flood water so that the total mean flow of the river will be made available for the generation of power.

Daily gauge records of the flow have been kept for over six years, and during the past three years a careful series of checks, measurements, and computations have been made, which go to show that a mean flow of 3500 cu. ft. per second can be utilized for generating power.

The total fall from the lake to tidewater will be made use of in two power houses; the upper plant, which is now in operation, utilizing 125 ft. maximum and 105 ft. minimum head, and the lower plant utilizing the balance.

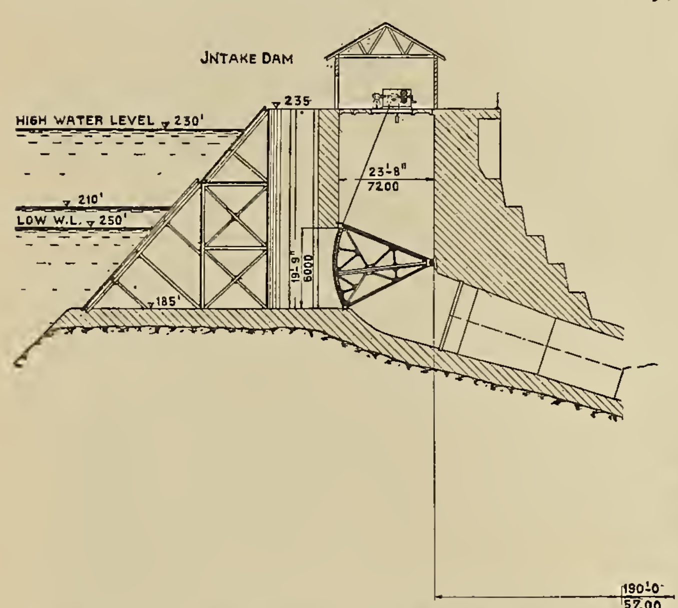
The site for the first development was chosen in the vicinity of Stave Falls, for at this point, the river is divided into two branches by a rocky island, half a mile long, admirably adapted for the construction of forebay and intake works while an old channel known

Whence Comes the Power

Upstream Side of Sluice Dam and Intake Dam, Showing Screens.

as the Blind Slough, with a rocky bed some 600 ft. wide at a higher level than the bed of the existing river, presents a most excellent site for a dam to provide for the flood discharge.

The second development will consist of a dam, 160 ft. high at the highest point, built in a narrow gorge to form a reservoir about three miles long, backing the water up to the tailrace of the upper plant. The power house will be located to the east of the dam, with its tailrace on tidewater, within sight of the main line of the Canadian Pacific Railway,



Elevation and General Plan of Stave Falls Power Plant.

and the penstocks for the turbines will be laid in tunnels about 1600 ft. long.

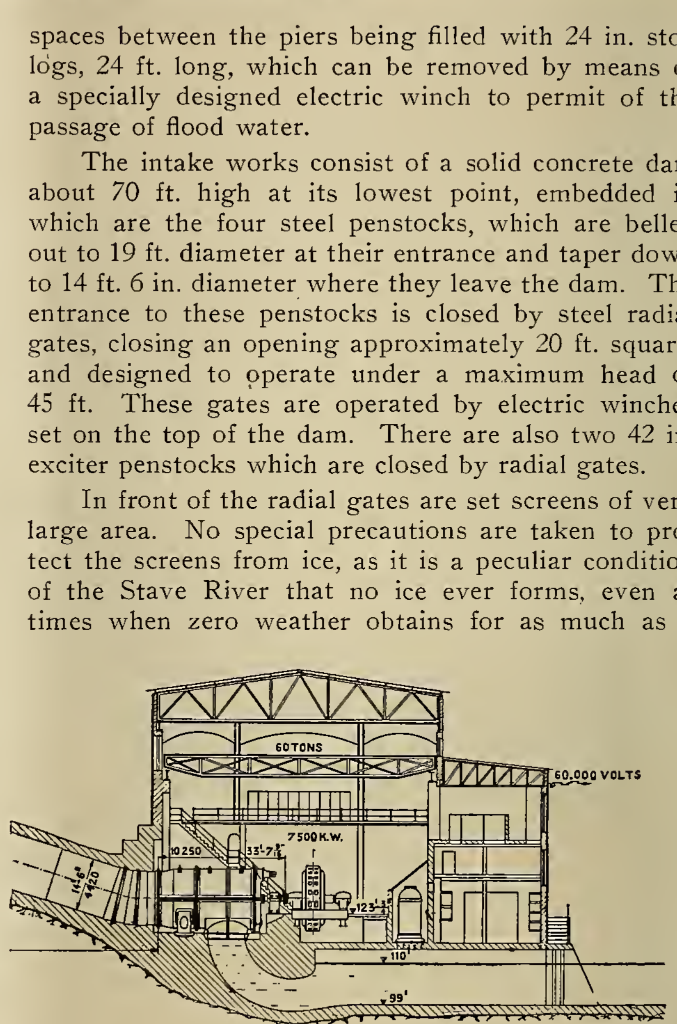
Description of the Power Plant.

The power plant, as it now stands, consists of a sluice dam 40 ft. high, provided with five sluice ways 22 ft. wide, to take care of the flood discharge; a solid concrete intake dam; two 14 ft. 6 in. steel penstocks with provision for two more; a power house with two 10,000 kw. units and provision for extension for two more; and a tailrace channel 1500 ft. long excavated in the old bed of the river.

The sluice dam, which was partially built by the Stave Lake Power Company, consists of four concrete piers, 8 ft. wide, with two abutment piers, the spaces between the piers being filled with 24 in. stop logs, 24 ft. long, which can be removed by means of a specially designed electric winch to permit of the passage of flood water.

The intake works consist of a solid concrete dam about 70 ft. high at its lowest point, embedded in which are the four steel penstocks, which are belled out to 19 ft. diameter at their entrance and taper down to 14 ft. 6 in. diameter where they leave the dam. The entrance to these penstocks is closed by steel radial gates, closing an opening approximately 20 ft. square, and designed to operate under a maximum head of 45 ft. These gates are operated by electric winches set on the top of the dam. There are also two 42 in. exciter penstocks which are closed by radial gates.

In front of the radial gates are set screens of very large area. No special precautions are taken to protect the screens from ice, as it is a peculiar condition of the Stave River that no ice ever forms, even at times when zero weather obtains for as much as a

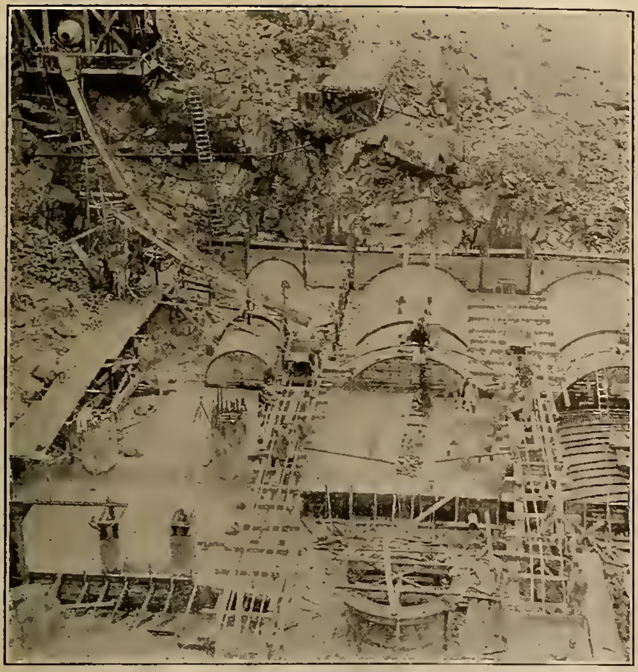


week. The reason for the non-formation of ice is that there is a large underflow from the forest during the winter months, which raises the temperature of the water.

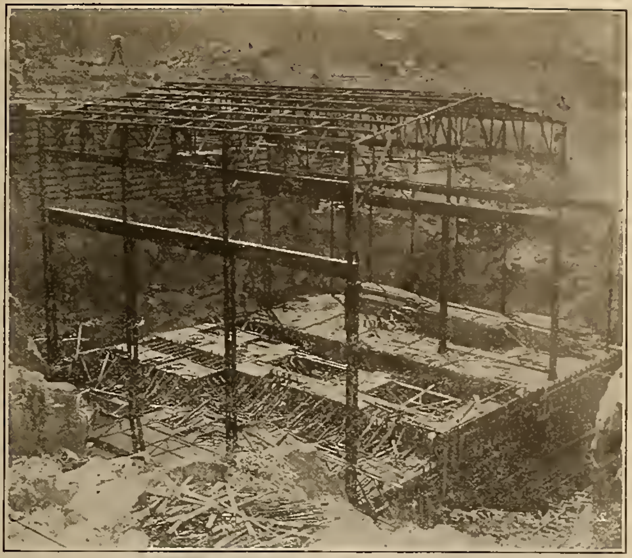
These dams are at present built to such a height as to store the water about 8 ft. above the original low water level of the lake. They are being raised this year an additional 10 ft., and next year they will be extended another 25 ft. in height.

The sluice dam in being carried to its full height, will be made into a solid dam, and will no longer be used for flood discharge.

Next year a sluice dam will be built across the Blind Slough. This will consist of concrete piers



Pouring Concrete for Power House Foundations.



Steel Superstructure of Power House.

30 ft. high, making 14 sluice ways, each closed by stop logs, which can be removed by an electric winch. Provision will be made in the design of these sluice ways, so that a Stoney roller gate can be placed in any of them if it should be advisable. But the operation of the stop logs has proved so economical and successful for handling floods, that it is not likely that more than one of the sluice ways will be closed by a Stoney gate. The Blind Slough dam will provide for a maximum discharge of 100,000 cu. ft. per second.

The foundations for the power house were excavated in solid rock. The total quantity of rock excavation for the penstocks, power house and tailrace amounting to 75,000 cu. yds.

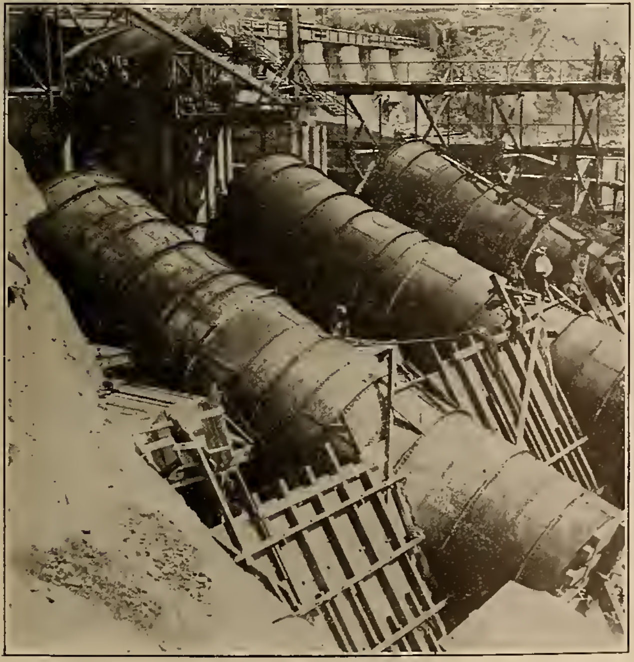
The tailrace canal is 70 ft. wide, and designed to run 10 ft. deep when all four units in the power house are in operation. In addition to the rock excavation for the tailrace some 75,000 cu. yds. of sand, clay and boulders were excavated by steam shovel.

Just below the power house a small V-shaped weir was built to hold the water to a proper height to seal the draft tubes. At present the flow of the river is rapid from below the foot of the tailrace, but when the lower plant is built, the water will be backed up to this weir.

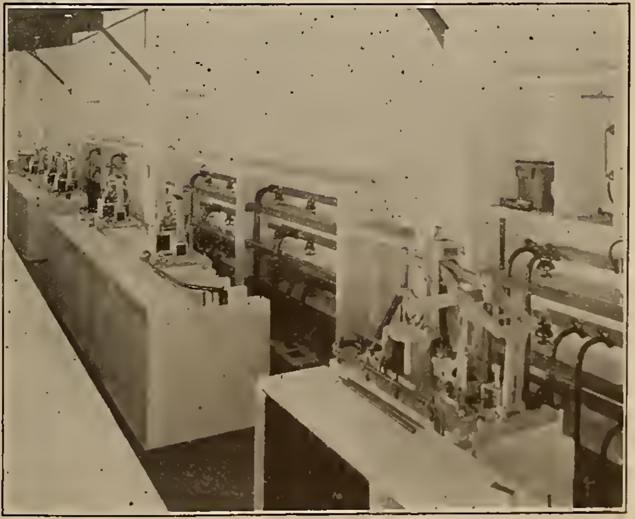
The foundations for the power house are of solid concrete construction, and the superstructure is a combined formation of steel and reinforced concrete. The building is 100 ft. wide by 90 ft. long. The turbine and generator room is 75 by 90 ft. and a two-story lean-to 28 ft. wide houses all the high tension and low tension switches. The control switchboard is on a gallery in a lean-to at the end of the building.

The power house is now being extended 70 ft. more for the installation of two new units.

In the power house are installed at present two 10,000 k.v.a. three-phase, 60 cycle, 4400 volt generators built by the Canadian General Electric Company, driven by two 13,000 h.p. Francis type turbines built by the Escher Wyss Company of Zurich, Switz-

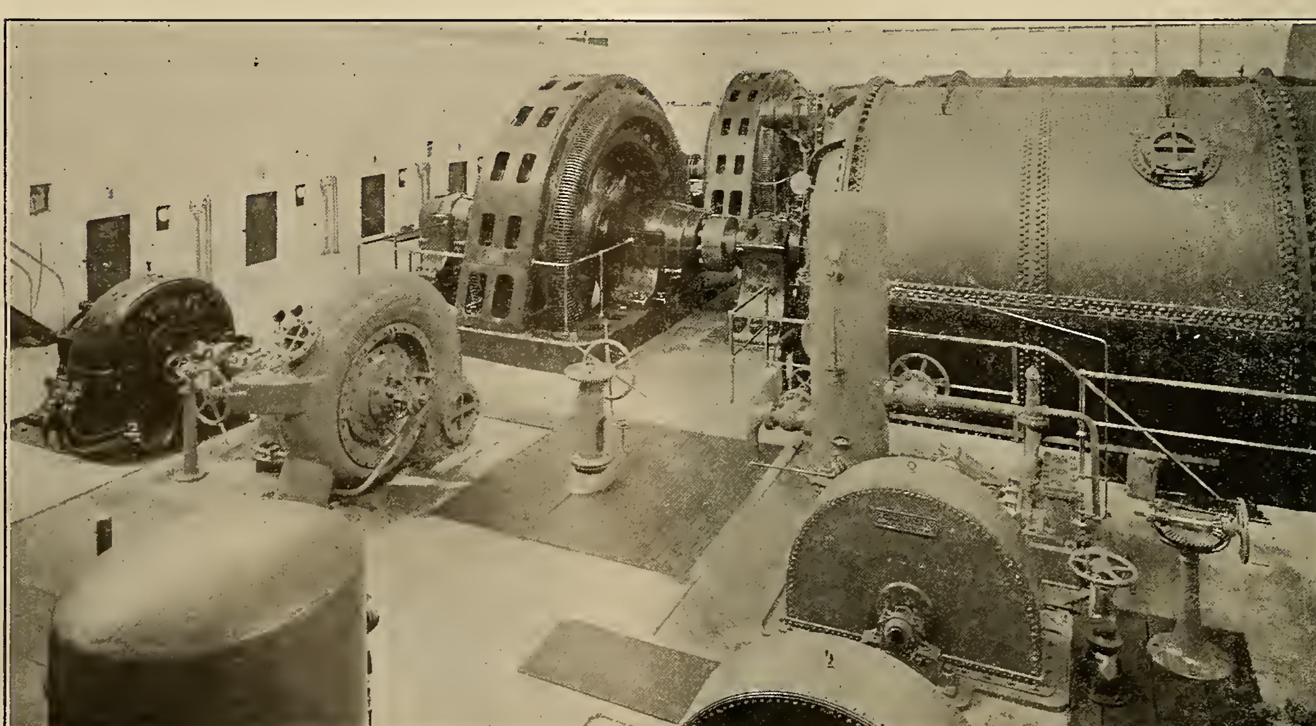


Riveted Steel Penstocks.

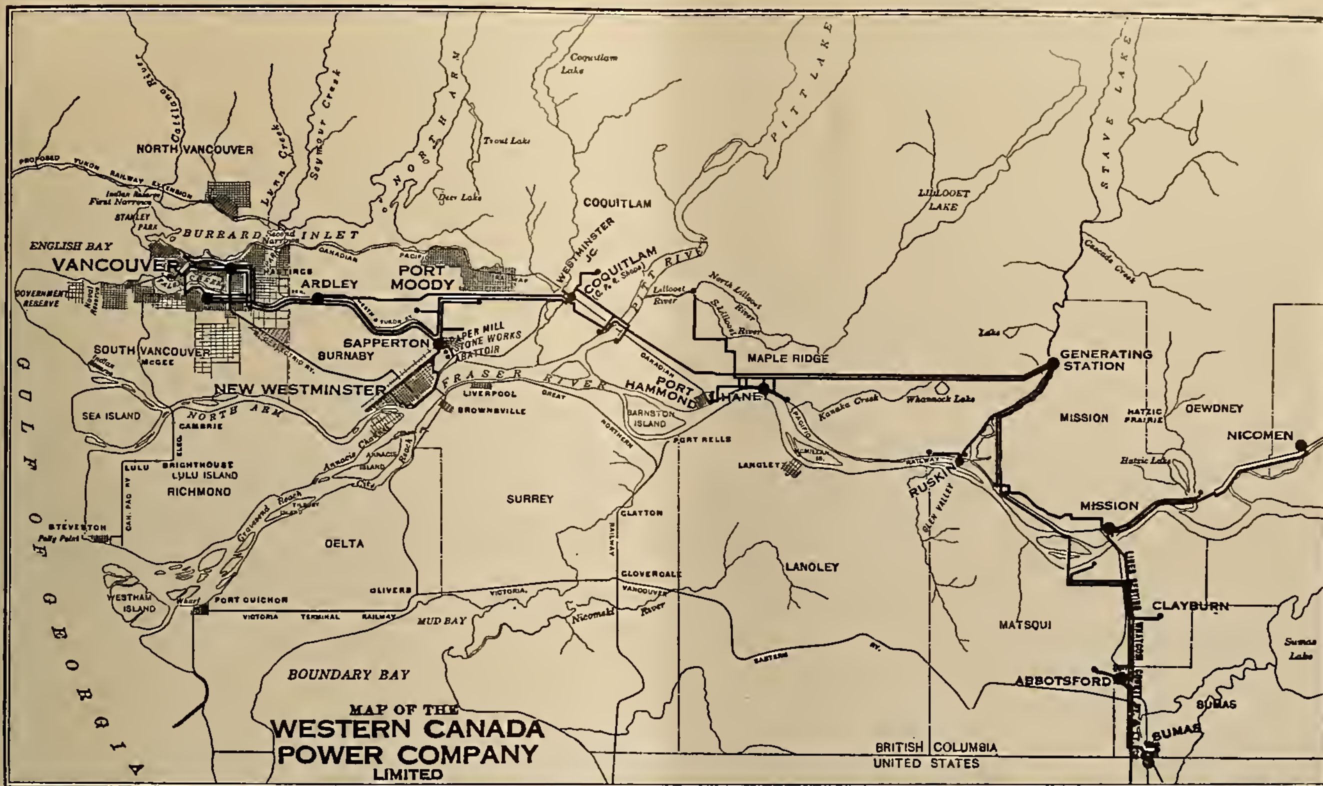


Low Tension Switches and Connections at Power House.

Switchboard Gallery at Power House.



Generators, Exciter and Oil Pump, Showing Transformer Compartments Along Left Wall.



Map of Transmission Line of Western Canada Power Company.

erland. Excitation is provided by two 250 kw. 125 volt generators, each driven by its own turbine, and each capable of exciting four machines. Governors and oil pumps were also provided by the Escher Wyss Company, the pumps being driven by individual wheels of the impulse type.

Six single-phase transformers of 3000 kw. capacity each are located on the main floor, each in its own concrete vault with a steel hatch as a top. A travelling crane of 70 tons capacity spans the entire main floor, placing the transformers as well as the generators and wheels directly under the crane. The control switchboard is in a gallery at the east end of the building, giving the operator full view of every piece of moving machinery. All switches are solenoid operated, and with the fuses are located in reinforced concrete cells in a concrete lean-to parallel to the main building.

There are at present three 60,000 volt, four 13,000 volt and one 4400 volt lines leaving the station. The 60,000 volt circuits leave by means of roof bushings through the concrete roof of the lean-to, choke coils being mounted directly above the roof bushings. The 13,000 and 4400 volt exits are made through the roof in three-phase lead armored cable terminating in D. O. A. terminals mounted on a pipe rack on the roof. This construction has proved to be satisfactory, a year's operation under severe weather conditions showing no faults.

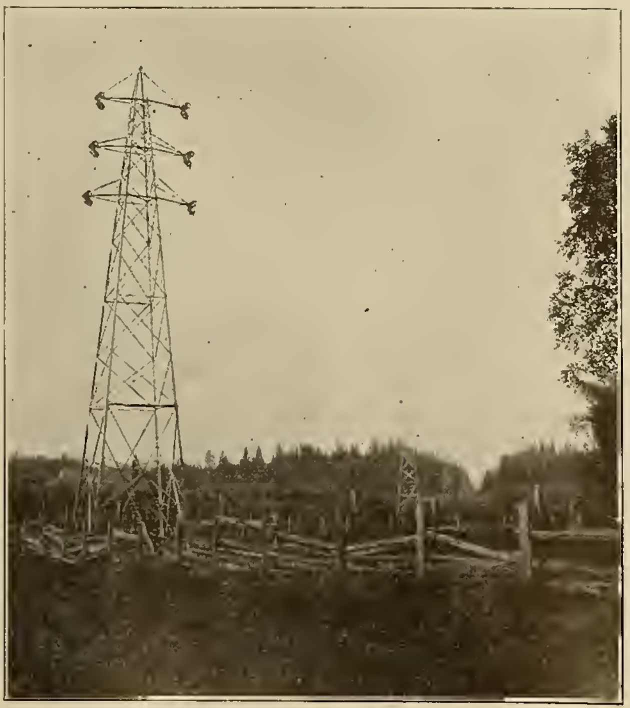
The main 32 mile transmission line terminates at the receiving station at Ardley, a point on the Great Northern Railway almost equi-distant from Vancouver and New Westminster.

Standard steel transmission towers spaced 660 ft. where possible, carry 2 three-phase circuits of No. O hard drawn, stranded copper cable with hemp center and one ⅜ in. galvanized steel ground wire, the overall height being 59 ft. and the point of support of the lowest wire being 41 ft. above the ground. For dead ends or sharp angles anchor towers capable of withstanding twice the strains of the standard tower were used.

High Tension Gallery at Power House.

Pitt River Crossing, Showing 165 ft. Tower.

The Pitt River, a navigable stream, is crossed on a span 1360 ft. in length, and as it was necessary to provide at least 100 ft. clearance at the lowest point of the span a special construction was resorted to. A galvanized steel tower 165 ft. overall in height, the low wire being suspended 140 ft. above the ground, was erected on a concrete and pile foundation on each bank of the river. A rocker tower is set so that the cables used at the crossing, which are of ½ inch plow steel, are at an angle of 45 degrees at the main line, the main span being dead ended at the rocker tower on each side, and being free to move longitudinally on the supports of the main tower so that these act simply as struts and have no strain due to the line itself. It was necessary to hang two sets of insulators in parallel, connected with compensating links, for each point of support and for the dead ends of this crossing, as the strains were too heavy for a single set of insulators. The rocker towers are securely anchored by 1 in. steel cables to concrete and pile anchors. All the insulators and hardware were supplied by the Ohio Brass Company, three of the ten-inch suspension discs being used in straight line construction, and four discs on strains. The towers were built by the Riter Conley Company of Pittsburg.



Anchor Tower at Angle.

The third 60,000 volt line runs south to the international boundary where it connects with the line built by the Puget Sound Traction, Light & Power Company into Bellingham, the total distance being 47 miles. This is constructed on wooden poles set on an average span of 200 ft., the longest span being 970 ft. at the crossing of the Fraser River, the supporting poles here being 130 ft. in height. Pin type insulators are used, the conductor being a No. 1 equivalent, steel core aluminum. Since this line has been in service it has had to withstand a seventy mile gale, with a temperature of approximately 32 degrees F., and in two other instances has had an accumulation

of sleet and snow so that the diameter ran up to over two inches without showing any signs of distress.

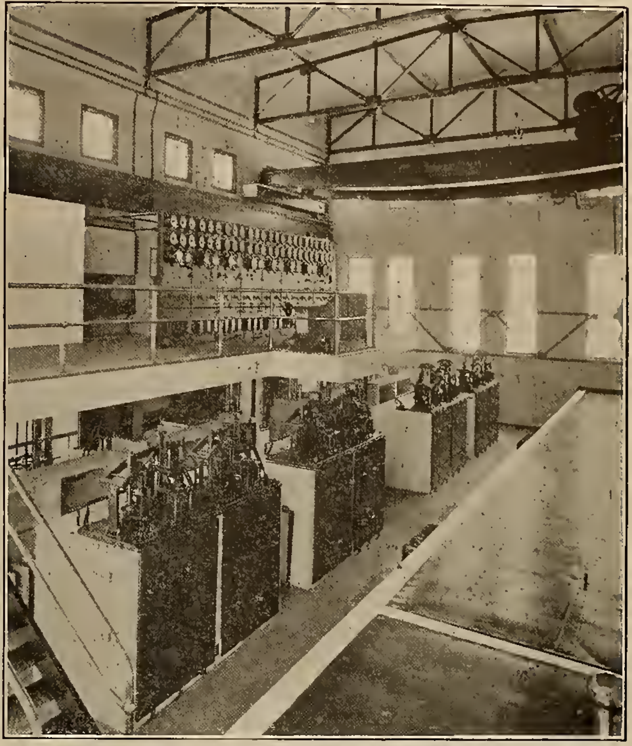
Thirteen thousand volts is supplied for local distribution from the power house to a distance of about 20 miles, the industries supplied being lumber mills, brick-yards, drainage pumps, quarries, etc., besides light and small power in the villages through

Receiving Station at Ardley, Showing 12,000 Volt Outgoing Lines.

which the lines pass. No substations are used on these lines, the transformers reducing to 2300 volts being outdoor type, placed on pole racks as near as possible to the service. In one or two cases, where the consumer has sufficient installation to warrant keeping an electrician, water cooled transformers, attended by the consumer's electrician, are placed in small corrugated iron buildings. It has been found that this method of distribution is much more satisfactory, due to the nature of the country and the character of the business, than the more generally used system of installing larger substations at intervals and radiating from these substations with 2300 and 4000 volt lines. Substation operators are thus eliminated, the patrolman on whose district the transformer is located, looking after it, and copper is cut to a minimum, the decrease in copper losses about equalling the increase in transformer losses.

Six 13,000 volt lines leave the main receiving station at Ardley, four running to Vancouver and two to New Westminster where the voltage is stepped down in small substations to 2300 volts for local supply. Power is distributed from these substations in 2300 volt, three conductor, paper insulated, lead covered, steel armored cable, laid directly in a trench 30 in. deep without any conduit or duct, services being laid in the same manner that a water pipe would be, tee box being used for making the joint. Section boxes installed at suitable intervals make it possible to isolate short sections without interfering with the balance of the cable.

As the company is primarily looking for power business and not for lighting, very little secondary cable is necessary, the majority of the services being at 2300 volts. Where secondary services are required transformers are placed on poles either on private property or in lanes, the cable service terminating in suitable cable pot heads. The secondary also is underground in the shape of a four conductor cable, star connected for 115/200 volts, connections on these cables being made hot. Very little cable trouble has been experienced. There is in operation at the present time about 25 miles of cable.



Interior Ardley Switching Station.

There is in operation at the present time 90 miles of 60,000 volt circuit (exclusive of the Whatcom County lines, which aggregate 125 miles) 138 miles of 13,000 and 246 miles of 2300 volt circuit, with 7658 poles. There are connected to these circuits 1157 customers, requiring 1551 meters and 574 distribution transformers, with a kilowatt capacity of 7606, exclusive of 13,000 volt stepdown transformers. The maximum demand on the power house to date has been 16,000 kw.

It is impossible in an article of this kind to go into details or to give more than a general idea of a large system, and consequently a number of photographs and sketches have been included which it is hoped will elaborate these notes and give the reader a much clearer idea of the layout of the Western Canada Power Company, than it is possible to do otherwise.

Rope drive, properly designed, is efficient and few ropes can be run on a drive with good efficiency. economical, especially where considerable power is to be transmitted, and where conditions are favorable to its installation no other known method of transmission will so well conserve power losses. The efficiency is greater at lower speeds than at higher, the dropping off being especially noticeable above 4500 ft. per min. of rope speed. The efficiency is not materially effected by distances between center up to 150 ft., and if proper care is exercised to have all grooves perfect in pitch diameter, many as well as

ELECTRICITY AND THE ARCHITECT.

BY C. S. WALTON.[1]

It may generally be said that the architect in America is always alert and ready to adopt any new and practicable device which will add to the comfort and convenience of the occupants of the buildings designed by him.

In no other country are there so many modern conveniences provided in plans and specifications, and it is due to this fact that the luxury of yesterday has become the necessity of today, and it is true that were it not for the watchfulness of the architect and his ability to see ahead and provide for future developments along certain lines our houses would be out of date in some respect before they were fairly occupied.

In Southern California the small house (on a large lot) has reached its highest development. The so-called bungalow is not a summer cottage for temporary occupancy, but is an artistic little home, substantially built, and designed to satisfy the requirements of people who are used to and must have all the conveniences and comforts. The transition from the bungalow to the palace is gradual and runs through a variety of houses, charming in aspect and perfect in appointment, but the bungalow must be so planned that its occupants may enjoy in a measure the same comforts as those who dwell in more pretentious structures. The reason for this is found in the fact that a large portion of our population is made up of well-to-do people who come here for the climate and for rest. They have had big houses and have struggled with the servant question and the social whirl and now they want peace and quiet, with sunshine and flowers and that freedom from care which the small home provides.

The architect has done wonders in developing this home along practical as well as artistic lines. It is a home for both the well-to-do business man, active or retired, and the man on a salary. Let us go through one of them and discuss its electrical requirements, having in mind the fact that electricity is now very cheap and may be used freely, if not wasted, without producing an unreasonably large bill at the end of the month.

The wasting of electricity is not well understood. Most people feel that if they turn off the current when they have finished with it all waste is stopped, but they do not know that their lights may be using twice as much current as would be necessary if they were properly placed and the glassware was of a character to give the best results in an economical way. Improperly placed lights and unscientific glassware will every day waste as much current as all other appliances in the house consume. In this one respect the architect can save his client a very considerable sum every month.

Speaking of appliances, and by this is meant all the various electrical devices which perform useful service in the household, they use very little current, and as their use is for a comparatively short time, the cost of running them is small compared with the service they render.

[1]District Agent Southern California Edison, Company.

Illuminating engineering is a well-developed science. The engineer will take the dimensions of any room, and after learning the use to which it is to be devoted and the general color scheme of ceiling and side-walls, will quickly determine the proper location for the lights, their size and the type of reflecting glassware necessary to give exactly the right illumination without wasting the light where it is not needed.

Consumers often complain that they have to use extra large lamps in order to be able to see to read and they blame the lighting company's service. Investigation generally develops the fact that an ordinary lamp, if properly placed, would supply ample light for reading fine print and the consumer is simply the victim of an unscientific lighting arrangement.

From the viewpoint of economical use of current for light, and this is an item that must be met every day, dark side-walls that absorb light without reflecting it are responsible for doubling the lighting bill. This is an ultra-conservative statement of a scientific fact, and besides the dark walls are depressing and are unsuited to the Southern California home.

Scientific papers frequently contain articles on the effect of strong light on the human eye and it is recognized that in this generation the eye is being subjected to a strain many times greater than it was intended to stand. What the ultimate effect of this unnatural condition will be is easy to predict, but it may be greatly improved by the illuminating engineer who always takes this fact into consideration when preparing a lighting scheme.

From the foregoing it will clearly be seen that much of the comfort and well-being of a household, as well as its economies, are dependent on the architect, and if he is not an illuminating engineer he will do well to consult with one.

The Southern California Edison Company has several high-grade illuminating engineers in its forces whose services are at the disposal of architects and the public without charge. These men have solved many difficult lighting problems for architects and have effected large economies which were greatly appreciated by the company's consumers.

Let us take a look at that bungalow. It is night and we will drive to it. We have some difficulty in locating it because the porch light is not burning and we cannot see the number. As we get out in front of the house the porch light is switched on, but still we cannot see the number because it is in the wrong place and the light does not strike it. House numbers should always be located where the porch light will illuminate them. How many times have you had to lay down an interesting book or interrupt a quiet little game to inform the inquiring stranger at the front door that the number he is looking for is in the next block?

The porch light is one of the most useful lights about the house. It gives the place a cheerful look and is better than a night watchman to keep prowlers away. If all the houses in the block burned their porch lights all night robbers and thugs would select some darker neighborhood for their work. This idea has received the cordial approval of the police departments of many cities. To burn a porch light all night

costs much less than one would think. Let us figure it:

Take a twenty-five watt lamp, which consumes twenty-five watts an hour, for, say twelve hours, which makes 300 watts a night. For thirty nights it would amount to 9000 watts, which equal nine kilowatt-hours for a month. Nine kilowatt-hours added to the monthly bill would be a small addition for the results obtained; much less than you would pay for a watchman.

Let us ring the door bell. We hear its sound and know that some one will answer. The architect has located it where it may be heard in every room and it is rung by the lighting current through a little bell transformer; no dry batteries to give out and the cost of the transformer paid many times in saving in repairs to bells and batteries. The amount of current used could hardly be measured and it lasts forever.

We are in the living room which is quite large. How pleasant is the light from the semi-indirect fixture. It is reflected from the ceiling against the side-walls and shows the pictures perfectly. There is not a light in the room to glare into the eyes; you can face in any direction without being blinded. On the table is an ornamental lamp connected with a receptacle in the floor, while on the upright piano is a lamp which lights only the music and keys and is connected to a receptacle in the baseboard. A well-shaded standing lamp by a grand piano will be both ornamental and useful. The baseboard receptacle will be needed in the day time for connecting the portable vacuum cleaner which is in such general use.

We pass into the dining room where electricity finds a dainty use in preparing many things for the table. The supply of current comes from the floor and the dining table is wired so that at a convenient point under the edge are several receptacles to which may be attached the coffee percolator, the toaster, the chafing dish, the griddle and the small stove. Ornamental lights for the decoration of the table may also be attached to these receptacles.

If there is objection to bringing the floor plug through the rug the floor receptacle may be located at the edge of the rug and one heavy cord run to the table receptacles. The floor receptacle should then be so located that the cord will run under a chair at the head or foot of the table where it will not be in the way of a person moving around the table.

A receptacle in the baseboard supplies the current for an electric fan, or a luminous heater to take the chill off a cold room on a cold morning, besides being useful for the vacuum cleaner.

In the kitchen the use of electricity becomes greater every day. The electric stove is now perfected and practicable and is economical in the consumption of current. It will do all the cooking, but is not adapted to boiling large quantities of water, which should be done by gas. Many homes have electric ovens and fireless cookers built into the walls, where they take up no room and are a great comfort and convenience.

Over a shelf against the wall is a row of receptacles to which may be connected any or all of the appliances used in the dining room and in addition the electric iron, knife grinder, silver polisher and the ice cream freezer, as well as the fan.

On the back porch is a receptacle for the electric iron, the washing machine and wringer, which are in very general use. The small electrically operated refrigerator, using no ice, is on the way and must be provided for.

Sufficient thought is rarely given to the supply of electricity in bedrooms. A well-planned home should have two baseboard receptacles in each of these rooms, one by the bed for the heating pad, vibrator and milk warmer, and another by the dresser for the curling iron, fan, shaving mug and ozonator, and for the sewing machine motor if there is no sewing room in the house. The vacuum cleaner and possibly the electric iron will be used in every room.

Sleeping porches should also be provided with a receptacle as the heating pad is indispensable in taking off the chill of the bed and driving away dampness.

The bathroom should have one receptacle for the vibrator and luminous heater, the shaving mug and the immersion heater.

Every closet should contain one well-placed light and particular attention should be given to the location of the telephone so that it may have a light near at hand.

The garage should be connected to the house by a three-way switch so that the lights may be turned off or on at either point, and the light should be located at the corner of each building in such a way that no dark places in the yard will afford a hiding place for prowlers. Such an arrangement will be found most useful in going to or from the garage and in illuminating the yard in case of attempted burglary.

Appliances should never be attached to lighting fixtures, as the fixtures will soon get loose and out of order and are not wired heavily enough to carry the necessary current safely. Receptacles in the dining room, kitchen and screen porch should be on circuits of extra heavy wire separate from lighting circuits, in order to carry ample current and possibly to effect a considerable economy in event of specially low rates being made for current used for other purposes than light. It is important that receptacles, except those designed for some specific purpose, be all of the same type and size, as nothing is more annoying than to find that a certain receptacle will not receive some appliance without a change of the plug.

A good rule to follow in planning a home is that when all the lights are turned on there will not be found a dark or poorly lighted place in any part of the house. Providing an ample supply of electricity does not necessarily mean the extravagant use of it, but it means convenience and comfort, and if the house is offered for sale it will surely be a most attractive feature to the possible purchaser.

The ample wiring of a house should be considered of the utmost importance and it should be done when the house is being built, as it is very expensive, unsightly and sometimes almost impossible to add to the wiring after the plastering has been done. The difference in first cost between a poorly and a well-wired house is small in comparison with the added convenience and attractiveness of the latter, and it is not an exaggeration to say that insufficiently wired houses will soon be considered old-fashioned just as were the houses of a few years ago that were not piped for gas.

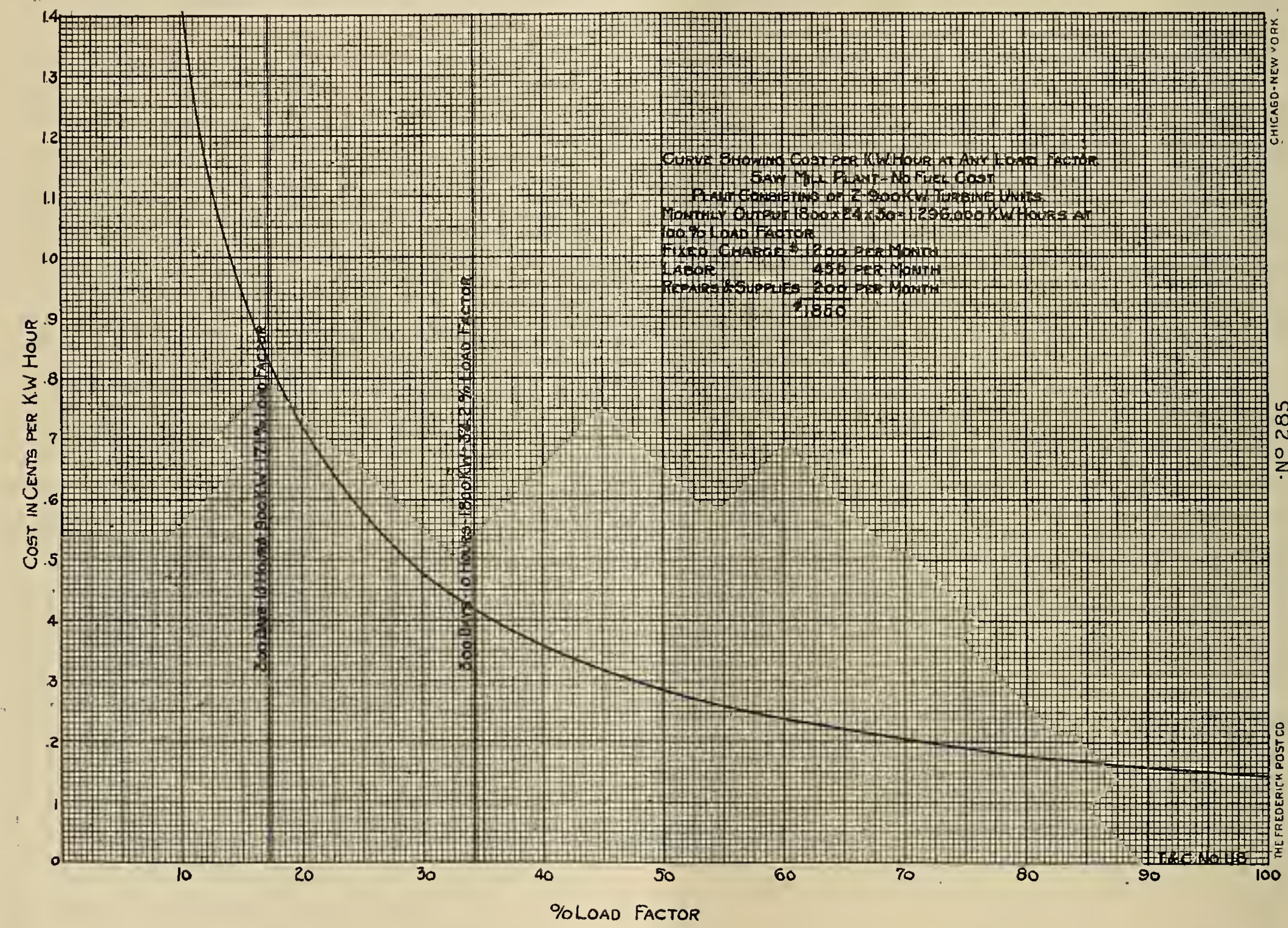
ELECTRIC POWER FOR THE SAWMILL.

The question is frequently asked whether a sawmill can generate electric power from mill refuse more cheaply than it can be bought from a central station. The following facts are intended to prove the affimative answer:

For example, consider a steam turbo-generator plant consisting of two 900 kw. units with a condenser equipment capable of maintaining 27 in. vacuum with 65 degree water. The boiler plant would consist of four 400 h.p. water-tube boilers, together with feed pumps, piping and feed water heaters. These, together with switchboard, station wiring and concrete building construction would constitute a complete plant which could be turned over to the customer in operating condition at a total cost of $120,000, exclusive of real estate.

economical this engine was than the old slide valve engine that the new engine replaced. After the unit was installed some time, the salesman asked the sawments and was answered that it did. The sawmill man then told him that it cost him more to run his plant with the Corliss than it did with the old slide valve engine as he now had to have two teams to haul away excess fuel. From the above you will gather that if a sawmill purchase current they will be put to certain expense in getting rid of extra refuse and any such cost should be added to the price for current.

There is no reason whatever why we should install reserve capacity on a sawmill plant, as the turbines will run just as many hours per year as a Corliss engine and no mill man thinks of installing a reserve engine. Reserve capacity is essential in a lighting and power plant where they must maintain con-



It is possible that, owing to the load factor, it would not be necessary to install as many boilers as we have figured on. Many sawmills operate with no mill man how he liked the engine. He said it was fine. He then asked if its economy came up to his state- spare boiler capacity and figure to clean nights and Sundays.

The accompanying curve shows the cost at various load factors and, of course, no account can be taken of fuel, as the mill people do not figure this item. In fact, when they figure to purchase current, there should be some charge for getting rid of excess fuel. It reminds me of the sawmill man that purchased a Corliss engine and was told how much more

tinuity of service. On the above basis, we are justified in estimating that this plant will carry 1800 kw. If the plant operates three hundred 10-hour days, this is an annual load factor of 34.2 per cent. If they keep one unit in reserve and operate 900 kw. three hundred 10-hour days, this gives them an annual load factor of 17.1 per cent. At 34.2 per cent annual load factor, $1850 per month plant charge, we have a cost of .417c per kilowatt hour.

The $1850 per monthh charge is arrived at, as follows:

Fixed charge at 1 per cent per mo, $120,000	$1,200.00
Labor	450.00
Supplies, repairs and incidentals	200.00
	$1,850.00

Other items, of course, might be added, but the above figures are sufficiently high to cover water, extraordinary repairs and anything of that nature. $450 per month labor charge for a plant of this size is excessive and $200 per month for supplies, repairs and incidentals is certainly high, so no one could question the monthly charge of $1850, except to say that it was too high.

The units on which we have estimated would be good enough for a lighting plant with the average load factor and the condenser equipment is certainly ample, and under ordinary conditions existing in a sawmill plant, this could be materially reduced.

The allowance for the building is $16,040, the contractor's profit to be added to this amount.

From the above analysis you will see that everything is figured liberal and we believe that under certain conditions where a party would not want such a fancy building and in the event they did desire a 100 per cent reserve capacity in turbine units, by trimming the plant down to the last cent, we could build such a plant at approximately $60 per kilowatt. The above figures are for power plant only and do not contemplate cost of real estate, storage bins or conveyor system, but do include the buildings, apparatus and everything necessary and essential to deliver current to the outgoing feeders.

PORTABLE ELECTRIC LIGHT LAMPS.

The United States Bureau of Mines has recently issued a Technical Paer, 47, by H. H. Clark, electrical engineer, entitled Portable Electric Mine Lamps. The paper states that the development and use of portable electric lamps for mines is just beginning in the United States and that the Bureau of Mines is interested in the subject because the Bureau believes that the safety of mining operations will be largely increased by the abandonment of flame lamps, except for gas testing, and the substitution of portable electric lamps. The locked safety lamp is the only portable lamp now used underground that is comparable as regards safety with a well constructed portable electric lamp. The author of the paper considers that the portable electric lamp is safer than the safety lamp.

To quote from the paper: "Even the locked type of safety lamp has its weak points. The omission or improper adjustment of some part may render the lamp unsafe and this condition may be effectually hidden from the user of the lamp and continue to exist until the lamp is opened and readjusted. The user has no means of detecting imperfect arrangement of lamp parts and must depend for safety upon the one whose duty it is to prepare the lamps for use. Reports indicate that safety lamps are not always properly adjusted in the lamp house—the filament of portable electric lamps is normally surrounded by a vacuum which as long as it exists absolutely prevents gas from coming in contact with the filament. If the vacuum is destroyed, the fact becomes evident in a few seconds at most, because the filament becomes dim and soon ceases to glow. Thus there is inherent in the construction of the electric lamp an effectual safeguard whose disappearance is announced automatically, unmistakably, and without delay. Moreover, though the destruction of the vacuum may give rise to a condition of potential danger, the air that takes the place of the vacuum removes the condition in a short time by causing the filament to burn in two. Therefore, it is not only impossible for the user of a portable electric lamp to remain ignorant of its unsafe condition, but it is also impossible for the unsafe condition to endure for more than a fraction of a minute.

"Although an electric lamp cannot be regarded as a safety lamp, if the latter be defined as a lamp that detects the presence of gas without igniting it, still if the presence of gas is known a well constructed portable electric lamp, even without special safety devices, would seem to be quite as safe as a safety lamp because while either may possibly ignite gas as the result of an accident, an unbroken safety lamp may cause disaster if its parts are improperly arranged."

The paper reviews the possible sources of danger in portable electric lamps and declares that the glowing filament of the bulb is the only source of danger as far as the ignition of gas is concerned. The paper recites at some length the author's experiments as to the ignition of mine gas by such sparks and arcs as could be obtained from the batteries of portable electric lamps even when the latter were short-circuited. The results of these experiments show quite conclusively that a portable electric lamp equipment whose battery potential does not exceed six volts could not produce a spark sufficient to ignite mine gas. Technical Paper 23 and Bulletin 52 of the Bureau of Mines show that certain sizes of miniature lamp bulbs are capable of igniting explosive mixtures of mine gas and air if the bulbs are broken so that their filaments are not injured. The author points out that if the bulb of a portable lamp is properly protected by its reflector and a stout outer glass, it would be a noteworthy exception if a blow that broke such a bulb failed to destroy its filament also; while noteworthy, it is however possible. The paper states, however, that not even that remote contingency need be feared if the mounting of the lamp bulb be so designed that a blow sufficient to break the bulb will at the same time short circuit it or open the electric circuit of the lamp. It is not yet certain whether the hand lamp or cap lamp will be more popular in this country. In Europe the hand lamp is used almost exclusively but the sentiment in the United States seems to favor the cap lamp, probably because there are so many open light mines in this country.

"After safety the next consideration is the production of a proper amount of light for approximately ten hours on one charge. The next is reliability of service, which is followed by lightness and durability. Convenience in handling and charging is an important characteristic. The outfit should not leak or spill electrolyte and it should not be necessary for the users to exercise care to prevent such leakage. In batteries that cannot be overcharged without injury, condition of charge is important in order that the batteries may not be continually overcharged and overdischarged to the detriment of the elements. Finally it is desirable that a battery should hold its charge during long periods of idleness.

EFFICIENT MANAGEMENT.

BY T. E. BURGER.

"Management" needs not the modification "efficient." Of necessity management must be efficient, otherwise it is not management but mis-management. Admitting then that efficiency is an integral feature of management, my definition and formula is simple; merely this:

Get the manager. Find the man and the rest is easy.

To analyze this formula offers a fine opportunity for patiently plodding through a panorama of platitudes. But as the mere recitation of truisms does not leave us with any tangible ideas from which can be gleaned applications for personal benefit, I will endeavor to hold forth on the attributes, characteristics and virtues essential in the man.

Let's put them down nakedly and justify them later.

1st—Integrity. 2d—Brains. 3d—Judgment. 4th—Energy. 5th—Imagination. 6th.—Sobriety.

First of all—yesterday, today and forever—integrity; that one paramount virtue which forms the basis of credit. The man of questionable integrity is handicapped far beyond the possibilities of his own conception and is bound sooner or later to fall. To fall does not necessarily mean that he cannot steal himself into a position of notoriety and perhaps retain his ill-gotten gains for life. But I maintain that in those things worth having; the esteem of his fellowmen, the confidence of his townsmen and, most of all, the approval of his own conscience, he is an utter failure A man of this type cannot be named without someone saying "Yes, but he is a crook," So the first fundamental cornerstone of success is business integrity.

Let those who think that any other attribute of a manager takes precedence, in importance, to integrity, think on. The fact remains that life is just one short step from the cradle to the grave, and is there time to dissimulate? "To thine own self be true, then canst thou not be false to any man."

A manager must of necessity live up to his definite characteristics, one of which is to be an adroit schemer. But all his schemes for the successful conduct of his work may be honest ones which in no sense could be so construed as to cast a shadow on his integrity.

Let us deal with the second most important characteristic of the manager. Gray matter in the cranium; chemically defined as chalk and water but commonly known as brains. There are lots of fools rattling round in jobs too big for them, but successful business establishments cannot long survive with an empty-headed ass in control. Some of these fellows are monumental bluffers but sooner or later the day comes when they are weighed in the balance and found wanting.

What we must have is a real trousered man at the head of things. A man placed there because of efficiency, for I deny that a "pull" of any sort can keep the incompetent man at the head of a successful business. "Pull" may place him there but a natural law will pull him out, or the business will go to pot.

We Americans, particularly the younger generation, are in such a hurry to achieve that we chafe under the necessary apprenticeship so important to future success. We all, if God has given us our birthright in brains, want to be captains of industry in from one to six months after getting a desk. Yet it is safe to say that none of our great business managers, except prodigies, ever reached their eminence without a long and arduous struggle.

It is only through this necessary and, what should be, enjoyable life labor that our mentalities are developed to a point where we can cope with the world as we find it, properly direct the efforts of a business organization and after each day's effort sit back with an honest realization of having put into our work all our endowment of mental activity at its high water mark of efficiency.

Our third attribute is judgment. This is not always an accompaniment of brains, though some may think so. Errors of judgment are common to us all, but I make the point that the more successful the business man the fewer his errors of judgment.

Here is involved the ability to think rapidly and clearly with the power for quick decision. Brains without judgment will achieve something sometimes. Brains plus judgment will accomplish something every time and hit the bull's eye nine times out of ten.

In judgment lies fifty per cent of a man's executive ability, that most essential feature, without which none of us would rise very far from the desk of a clerk. The ramifications of a manager's judgment are multifold and these subdivisions are called into play for every important feature of his work.

There's judgment in hiring his employees, judgment in firing them, judgment in his attitude toward them, judgment in analyzing his business, judgment in supervising the relations of his representatives to his trade, and judgment in deciding all of the numerous daily questions coming up on every hand.

A good executive, every manager must be and ability of this nature cannot exist without good judgment.

Men with this quality well developed do not become inflated with success and go to extremes of expansion, nor do they become unduly depressed by criticism or failure and go to the opposite extreme of panic-stricken retrenchment.

Grover Cleveland said that "The best executive is the man who can find others to do his work as well or better than he can do it himself." So here's where judgment has to come out good and strong in selecting the proper people to specialize on the various features of your routine until they are experts, each in his own department..

Our fourth qualification is energy. There are two varieties of this virtue, well directed energy and the other, which is one of the worst faults in business, misdirected energy. We have all seen men whose sole occupation seemed to consist of running a private marathon in circles, disturbing an entire establishment and creating discontent at every jump. Energy properly disposed is to be likened to a constant-speed, smoothly-running motor, every motion counting for construction rather than destruction.

Without health no man is in fit condition to withstand the onslaughts of business life; therefore assuming that the manager is the happy possessor of good health, then energy hinges on mental activity. Could we but make it a daily practice to figuratively look ourselves in the face and ask ourselves how much of the day has gone by while the juice was turned off of our brain, we would all soon discover that a greater amount of mind action would rest rather than tire our "think-boxes" and result in enhancing physical energy, which is but the galvanic activity of a constantly working mentality.

The man of energy is seeking for no amelioration in his work. He realizes that his life is only what he himself makes it and that no task is hard unless he sees fit to admit its difficulty. He wastes no time in crying over spilt milk but, if errors of judgment have crept in, he is quick to see, to rectify and to seek new fields for his effort. What might seem insurmountable obstacles are to this man but stepping stones toward greater achievements. There is so much to be said on this, I have taken the liberty of writing the following Biblical paraphrase.

Though I work with judgment and brains and have not energy I am become as a lazy loafer or a dreaming idler. And though I have the gift of analyzing and understand all

technicalities and all prices and though I have all integrity so that even my competitors trust me and have not energy, I am nothing. And though I bestow all my time to my business and though I give the boy orders to bring my lunch to the office and have not energy, it profiteth me nothing. Energy worketh incessantly and is effective. Energy demolisheth not; energy patteth not itself on the back, is not self satisfied. Doth not worry over trifles, seeketh not ways and means, is not easily exhausted, thinketh no troubles. Rejoiceth not in getting the better of a competitor, but rejoiceth in everybody's prosperity. Forceth all things, impresseth all things, moveth all things, pulleth all strings. Energy never faileth; but whether there be good judgment, it might fail; whether there be brains, they might not know; whether there be influence, it might vanish away. When I was a clerk, I spoke as a clerk, I understood as a clerk, I thought as a clerk; but when I became a manager I put away eye-shade and bill-book. And now abideth judgment, brains, energy, these three; but not the least of these is energy.

Next comes imagination. Old Isaiah wrote "Without the vision the people perish." I believe there is somewhat of a misconception as to what imagination signifies, it is so easily confounded with fancy. Imagination is the mental power which enables us to combine the products of knowledge in new forms, while fancy is but a superficial faculty which flits about the surface of things. A manager to be successful must be able to look ahead; to "take a notion," to plan with a big degree of accuracy for the future. He must be able to feel the public pulse, to detect the underlying sentiment of the country and "put his house in order" to meet changing conditions. We see lots of good fellows who are narrow minded, who are unable to look beyond the day's work—they need imagination, they need the ability to "take a notion."

Imagination backed up by that most necessary personal quality of courage is what enables a man to break away from tradition—to do differently what has always been done; to do what has never been done before.

Imagination tends to make a man more liberal minded, more public spirited, it helps him to look at things from other view points than his own.

And last of all for our sixth qualification I would speak of sobriety. There is no man really successful who "Sees through a glass darkly." Show me a single man who can keep his faculties, well balanced and properly controlled, with a lot of booze aboard. And the public is learning more and more to distrust such men. Proportionately there is not half the drinking among business men today as could have been found twenty-five years ago. It is bad for business and bad for the fellow.

A manager's staff, his heads of departments, are bound to reflect the vices or virtues, the character, methods and ideals of their chief, and they in turn are exemplifying, in their various departments, and in their relationship and cooperation with one another, fundamental principles of efficiency which are based very largely on the example set.

To sum up all that I have been elaborating in this article, I believe that if any commercial enterprise is a conspicuous success it is because of the personality of its manager; because he has gathered about him and developed men of his own courageous, stable, dependable qualities, and because he and they have built up an organization in which every unit is properly selected, carefully assigned and intelligently and considerately managed, so that the application of the principles of efficiency, which are but natural laws of success, is instinctive.

And now after all has been said; after we have endeavored to name and justify the six essential requisites of the manager, there are, no doubt those who, hearing, are tempted to ask where such a superman is to be found.

My reply is that some of us possess some of the qualifications and some of us a little of them all, and all of us, if we so choose, can make it the business of our lives to fit these things, so necessary to our success, into our characters. In closing let me modify a quotation from Henry Drummond. "Is life not full of opportunities? Every man, every day has a thousand of these opportunities. The world is not a playground; it is a school-room; Life, no holiday, but an education, and the one eternal lesson for us all is, how better can we do our work."

ELECTRICAL DEVELOPMENT AND JOVIAN LEAGUE OF SAN FRANCISCO.

The first meeting of the Electrical Development and Jovian League of San Francisco since the summer recess will be held on Tuesday, September 2, when Robert Newton Lynch, executive head of the Chamber of Commerce and of the California Development Board, will address the members. A large and representative attendance is already assured, and a profitable session is promised to all who attend.

W. S. Berry, as president of the League, has received an invitation to be present at a meeting of the presidents of similar societies and the manufacturing companies to be held at Association Island, New York, September 3d to 6th, in connection with the plans of the Society for Electrical Development, to which J. Robert Crouse has added a contribution of $10,000 to the $130,000 already raised toward the initial $200,000 subscription.

Association Island Meeting, September 3 to 6, 1913—Program.

Mr. J. B. McCall, Chairman.

Afternoon Session, September 4, 1913.

1. "Government in Relation to Business," Wm. D. McHugh, Omaha, Neb.
2. "Distribution of Electric Energy—Present and Future," Samuel Insull, president Commonwealth-Edison Company, Chicago, Ill.

Evening Session, September 4, 1913.

3. "Future Technical Development in the Electrical Business," Dr. Chas. P. Steinmetz, General Electric Company, Schnectady, N. Y.
4. "State Commission Control," chairman or some member of State Commissions of Massachusetts, New York or Wisconsin.

Afternoon Session, September 6, 1913.

5. "Society for Electrical Development," Henry L. Doherty, president H. L. Doherty & Co., New York City.
6. "Principles of Resale Control," F. P. Fish, Boston, Mass.

Evening Session, September 6, 1913.

7. "Financial Outlook," Frank Vanderlip, president National City Bank, New York City.
8. "Favorable Condition for Labor," Dr. Thomas Darlington, secretary Welfare Committee, Iron & Steel Institute.
9. Presidential addresses, J. B. McCall, president National Electric Light Association; C. E. Scribner, vice-president American Institute of Electrical Engineers; Preston Miller, president Illuminating Engineering Society; S. O. Richardson Jr., president Manufacturers' Club; Franklin Overbagh, secretary Electrical Supply Jobbers' Association; Ernest Freeman, president National Electrical Contractors' Association; F. E. Watts, Jupiter of Jovian Order.
10. Thomas A. Edison, guest.

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POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Political versus Private Operation

By a vote of four to one, the people of San Francisco have decided to assume a bonded indebtedness of three and a half million dollars in order to build sixteen and a half miles of municipally-owned electric railway. The immediate results of this action should be most beneficial. Adequate transportation will be secured to the grounds of the Panama-Pacific International Exposition, as well as to certain sections hitherto denied needed service because of the impossible franchise restrictions imposed by the city charter, and the city will be enabled to enjoy a normal growth in population which must invariably be preceded by transit facilities.

But the ultimate method of operating these lines is a question of deep concern to the people of San Francisco, who well know the inefficiency, and worse, of the average municipal employee. While the present Mayor is admirably qualified to superintend the construction, there is no guarantee that future administrations will be any better than some of those in the past. Political operation of municipally-owned public utilities is capable of far greater abuses than have ever been revealed in private operation of privately-owned utilities. The far-sighted man looks to ultimate results, not immediate benefits. Municipal ownership of any utility discourages private investment in other utilities and thus eventually retards the growth of the city.

This journal in the past has consistently advocated municipal ownership under private operation as an ideal susceptible of practical accomplishment, whereas political operation could be successful only in Utopia. This first step toward accomplishing this ideal has been taken; we earnestly suggest that the second step be private and not political operation.

Better Estimating Methods

A movement has been launched by a number of architects, engineers and contractors to form a new society to be known as the American Institute of Quantity Surveyors. The purpose is to develop better methods of estimating and dealing with bids, substituting certainty for the present gambler's chance that many bidders take. While this organization is of interest chiefly to the building trades it has valuable suggestions for those in the electrical business who could profitably adopt some of the plans proposed.

In the past there has been too much "guestimating," too little judgment and not enough co-operation among bidders. A quantity surveyor is one who is qualified by experience to standardize the quantities upon which all contractors will be called to bid, thus reducing it to a science, which is merely organized knowledge. If each contractor is furnished with an accurate bill of quantities, a schedule containing itemized quantities of all materials and labor entering into the contract, he can make an intelligent bid, fair alike to himself and to the owner. Thus will the industry benefit from this commendable undertaking for which G. Alexander Wright of San Francisco is sponsor. Waste in bidding is due to ignorance of cost, efficiency to knowledge.

Selling to the Ultimate Consumer

Selling electrical appliances, as distinguished from the older lines of business, is handicapped by the lack of an adequate retail outlet. The manufacturer, by means of better machinery, methods and men, has reduced the cost of his output again and again, so that his end of the business has been developed to such a high state of perfection that the next improvement in efficiency must come from the distributing side. When one-sixth of the cost of an article is due to the cost of selling it, the ultimate consumer, "from whom all blessings flow," has good reason for complaint. While such a state of affairs is naturally to be expected in any new business, the sooner it is corrected the more quickly will the business assume a stable and normal condition. What with low profits and high operating expenses, anything which tends towards simplicity and economy in methods of conducting business should be welcomed by the seller, who will then be enabled to give the buyer better service in the way of quality and delivery.

For example, the complicated system of multiple discounts now in force would be farcial if not so serious. The basic fifty per cent discount from list is a joke which in no way tends to create confidence in the mind of the buyer. Then the additional tens and fives and twos and ones, ad infinitum and ad nauseam, make an unnecessary tax on the mathematical faculties of both buyer and seller and invariably result in needless confusion. A company recently entering the electrical field has superseded this practice by employing a discount of but two figures, a method which should give a certainty and stability hitherto lacking in the business. This company also proposes to sell conduit on the same rational basis that any other kind of pipe is sold, the weight per hundred feet being the determining factor. Furthermore, the goods are handled too often; they are sold and re-sold, shipped and re-shipped. Each time they are moved a new cost is added, which in no way adds to the value of the article to the consumer.

This is not intended as a brief for the mail order house or other means whereby the manufacturer sells direct to the consumer. The jobber is as necessary in the electrical business as is the clearing house in the banking business. These conditions are merely cited as examples where lost motion in the machinery of distribution wastes the power of selling.

Of far more immediate concern, is the subject which introduces this paper and from which we have slightly digressed, the lack of an adequate retail outlet. Reduced to its fundamentals, the matter is primarily a decision as to whether it is better to utilize existing machinery or to devise a new method of distribution. Can the great volume of electrical business which will finally be developed be carried in the present channels of some other business, or must a new channel be dredged for its exclusive use? Where should the layman be directed to buy his electrical appliances?

Various methods are now on trial. One enterprising manufacturer is availing himself of the drug store, using a heating pad, a milk warmer or vibrator as an entering wedge to induce the druggist to stock other devices. Others are enlisting the services of the grocery store, the initial step being a demonstration of electrically cooked food. Some are resorting to the department store, with its lure of bargain prices. A few sell direct through the mails by means of periodical advertising while many are employing the hardware store as the logical retail outlet. Others have fallen back upon the central stations, many of whom desire to control the character of current-consuming devices on their line. Finally there are a very few aggressive ones who are starting specialty shops selling only electrical equipment.

While the last named method is by all odds the most satisfactory, it is possible only in large cities. The secret of its success lies in its selection of trained salesmen. A thorough understanding of the action of electricity is as essential for the electrical merchant as is a knowledge of the action of drugs for a druggist. Certain precautions are necessary in using electrical appliances which can not be explained by the sales girl in a department store. So "where the goods are sold" is a minor importance to "by whom they are sold." The ordinary clerk in a pharmacy, grocery or hardware store is not fitted to sell electrical devices, though some clerk who has been properly trained can be trusted with such sales and furthermore can be counted on to make a far better showing on account of his specialized knowledge.

Electricity, like fire, is a good servant but a bad master. Few people realize the risk they run in using the improper fuses that the average hardware man might supply. No druggist is capable of advising as to what special switches are necessary to control heating devices or motors. A mere sales girl does not know that ordinary lamp cord should not be used instead of reinforced cord when a lamp is to be carried around or hung on a nail, nor does a grocery clerk know the danger of a paper lamp shade.

What is needed then to improve the efficiency of sales distribution is a school for retail salesmen of electrical goods who can go out and deal with the ultimate consumer just as the manufacturer's representative sells to the central station, jobber or contractor. The salesmen should be given a working knowledge of what electricity is in its practical sense, what is can do to lighten labor in home, farm and factory. He should understand the units in which it is measured and the relative amount required by different devices. This does not mean an engineering education, for an engineer is not a merchant who finds deep delight in dealing with the public, nor does he get the consumer's view point. Selling is the acme of endeavor in the industry, and yet it has not received a tithe of the attention which has been devoted to manufacturing. Here is indeed a work worthy of the efforts of some great organizatior such as the Society for Electrical Development.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

G. C. Harris, general manager of the Tulare Telephone Company, was at San Francisco this week.

F. N. Averill, manager Fobes Supply Company, Portland, made a business trip to Seattle last week.

P. E. Overend, sales specialist of the Northern Electric & Manufacturing Company, was recently in Victoria.

H. W. Reynolds of Chas. C. Moore & Co.'s San Francisco office, has returned from a flying trip to Pittsburgh, Pa.

W. Stranahan of the San Joaquin Light & Power Company at Fresno, spent his vacation in San Francisco during the past week.

Geo. Walton, manager for the California & Oregon Power Company, at Klamath Falls is making a several days' stay in San Francisco.

H. L. Jackman, manager of the Western States Gas & Electric Company, at Eureka, was a visitor in San Francisco during the past week.

K. A. Schaller of the railway and lighting division, Westinghouse Electric & Manufacturing Company's Seattle office, was in Portland recently.

Howard Joslyn, city electrician of Seattle, was elected fourth vice-president of the Municipal Electricians, at their recent Watertown, N. Y., convention.

P. F. Sise, managing director of the Northern Electric & Manufacturing Company of Montreal was recently in Vancouver, while on his annual inspection trip.

R. S. Hunkins in charge of the electrical department, Fairbanks, Morse & Company's Seattle office was in Mabton, Washington, last week on company business.

Mr. Stewart, local manager of the Mt. Whitney Light & Power Company at Porterville, Cal., spent the major portion of last week on a vacation visit to San Francisco.

Arthur Kempston, assistant chief of the Department of Electricity, San Francisco, returned to the city during the week after a wedding trip which embraced the southern part of the state.

G. D. Jones, electrical engineer of the Department of Engineering, Sacramento, visited San Francisco during the past week enroute to Los Angeles, where he is looking into some state installations.

Jesse W. Lilienthal has been chosen by the stockholders of the United Railroads of San Francisco as president, to succeed **Patrick Calhoun**, and has been given the proxies to name the entire directorate.

A. E. Garland, special factory representative electrical department, Fairbanks, Morse & Company, with headquarters in Chicago, is in Seattle on special work. He will visit the various houses of the company on the coast before returning to Chicago.

W. S. Berry, sales manager for the Western Electric Company, San Francisco, left last Tuesday for an extended trip East, visiting the Grand Canyon, Chicago and New York while away. He will also be an attendant at the Jobbers' convention at Buffalo, September 9 to 11.

J. P. Davidson, formerly representative for the W. F. Boardman Company, of San Francisco, has resigned to accept a position with the Pacific Coast office of the General Gas Light Company at San Francisco. Mr. Davidson will cover the territory of California, Arizona and Nevada.

Henry F. Holland, western representative for the Simplex Electric Heating Company, has returned to Salt Lake City after a trip over his territory extending over a period of a month. Mr. Holland reports trade conditions good and especially a rapidly increasing demand for electric ranges.

F. H. Wright of Covina, Cal., was at San Francisco last week, where he appeared before the State Railroad Commission in support of a bond issue recently applied for by the Covina Telephone Company. The bond issue which was authorized by the commission provides for extensions in this company's system. Mr. Wright is general manager of the company.

A. E. Griswold of the A. G. Electric & Manufacturing Company of Seattle, has been at San Francisco for the past two weeks looking over the field in reference to starting an agency for his Seattle house. He is carrying a good line of switchboard apparatus and comes highly recommended. Mr. and Mrs. Griswold came from Seattle in their machine and expect to take in San Diego and Los Angeles before returning home.

C. B. Hawley, president and general manager of the Intermountain Electric Company, left Friday on an Eastern trip, accompanied by his wife and daughter. While away they will visit Denver, Boston, New York, Washington, Detroit, Chicago and Niagara Falls. At the latter point he will attend the Jobbers' Convention, September 9th, 10th and 11th. He will represent the Utah Electric Club at the convention of Associated Electric Clubs in New York, September 6th.

Geo. Duffield, for the past three years special representative of the National Electrical Contractors, has been selected by the executive board to fill the unexpired term of **W. H. Morton**, the National Secretary. Mr. Morton has filled the position as secretary for the past thirteen years, ever since the organization was started, and it is with a great deal of regret that the contractors throughout the United States are giving him up. He has formed a company at Porto Rico for the development of pine apple and grape fruit land.

OBITUARY.

Matthew Maury Corbin, special agent for the General Electric Company at San Francisco, Cal., died at Charleston, West Virginia, on August 24th, from an attack of pneumonia after an illness of three days. Mr. Corbin has been connected with the General Electric Company for the past fifteen years, representing them in their railway traction department. He had been with the San Francisco office for two years and was shortly to be transferred to Philadelphia. His work brought him into contact with many persons who soon became his friends and who greatly deplore his death. Mr. Corbin was born at Lexington, Virginia, thirty-nine years ago and was graduated from Virginia Military Institute. He was an associate member of the American Institute of Electrical Engineers and a member of the Engineers' Club of New York and San Francisco. Funeral services were conducted in Charleston and the body was taken to Lexington. The deceased leaves a wife and two children, who were at Berkeley at the time of his death.

PACIFIC COAST GAS ASSOCIATION.

The 21st annual convention of the Pacific Coast Gas Association will be in session at San Jose, California, September 16th, 17th and 18th, 1913, and will be presided over by Mr. C. S. Vance of Los Angeles, Cal., and at which meeting the following papers will be presented.

President's address .... C. S. Vance
1. Oil Gas .... Leon B. Jones
2. Industrial Uses of Gas .... John B. Rodd
3. Rate Making .... Dr. A. C. Humphreys
4. Modern Gas Distribution and Part Played by Automobile .... D. E. Kepplemann
5. Gas Street Lamps .... C. S. Babcock
6. Gas Company's Public Policy .... L. A. Wright
7. Standards of Quality and Service for Oil Gas..H. M. Papst
8. Wrinkles .... H. W. Burkhart
9. Experiences .... John Clements
10. Novelties .... H. P. Pitts

Everything points toward a goodly attendance upon the convention. The annual banquet of the association will be held at the Hotel Vendome on Wednesday evening, September 17th; and on Thursday the members and their families in attendance upon the convention will, as guests of the San Jose District of the Pacific Gas & Electric Company, be entertained with a trolley trip through the beautiful Santa Clara Valley to the famous Alum Rock Park where luncheon will be served, and after which dancing and other amusements can be indulged in by the members and their families.

BOARD OF DIRECTORS FOR CALIFORNIA STATE CONTRACTORS' ASSOCIATION.

C. V. Schneider of Sacramento, president of the California State Association of Electrical Contractors has appointed the following board of directors to assist him in state work during the coming year: N. Hope, San Francisco; J. C. Rendler, Los Angeles; C. Heilbron, San Diego; Geo. King, Oakland; H. Miller, Pasadena; J. S. Reynolds, Santa Barbara; L. Youdell, Stockton; F. Somers, San Jose; E. F. Burkhart, Palo Alto; C. Goodwin Frankish, Pomona; E. H. Hann, Riverside; M. Phillips, Ventura; J. Endert, Bakersfield; W. D. Thomas, Marin and Sonoma counties.

UTAH LIGHT & RAILWAY COMPANY OUTING.

The third annual outing of the employes of the Utah Light & Railway Company was held at Wandamere Saturday, August 16th, and all company business was suspended at 11 o'clock in order that employes might prepare for the occasion. Free transportation to the park and free tickets of admission was provided by the company. About 500 employes with their families took advantage of the outing offered.

The first event—a baseball game between the Light & Power and the Railway Department was won handily by the electric light nine by a score of 16 to 9. The railway men were unable to integrate the sine, flat top, peak top and spiral curves of Pitcher Hall of the meter department. The winners of the other events follow: 100 yard dash, Elmer Redfern, of the Line and Service Department; Ladies' Peanut Race, Mrs. Wilson of the Shops Department; Ladies' 50 yard Dash, Miss Johnson of the Line and Service Department; Relay race for heads of department with one assistant, C. H. Jenkins and Elmer Redfern of the Line and Service Department; Pole Climbing, John Hiseman of the Line Department; Rope Throwing, S. J. Swyers of the Line Department; Pie-eating, Fred Hartley of the Shops Department. The tug-of-war between the Shopmen and the Line Department was was won by the shopmen.

Henry Dunbar, of the Line and Service Department, was there as usual, and provided a continuous performance of amusement for the children and grown-ups with his funny makeups and antics. He entered the ladies' 50-yard dash and finished first in the event, but was disqualified by the judges due to the fact that his slit skirt exceeded the limits prescribed by the rules. He also entered the pie-eating contest, but lost because he said the pie was too good to bolt it as the rest of the fellows were doing.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

A decision has been rendered authorizing the Tulare County Power Company to issue ten promissory notes in the aggregate face value of $50,000, secured by $66,500 of bonds, to replace similar notes held by Thomas C. Job. The commission denied the application to pledge $4000 of bonds to secure $3243 interest on notes held by Mr. Job.

The Great Western Power Company has applied for a modification of the Commission's order granting authority to issue bonds of the value of $4,411,000.

A decision was rendered denying the request of the Oro Electric Corporation for a rehearing of the application for permission to serve certain portions of San Joaquin County and the city of Stockton.

A decision was rendered authorizing the Oakland, Antioch & Eastern Railway Company to issue $1,000,000 of bonds. The proceeds will be devoted to constructing a line of railway from Bay Point to Sacramento.

Authority was granted to the Delano-Linns Valley Telephone Company, to issue $250 of stock, and to extend its system in Kern county.

The Oakland, Antioch & Eastern Railway Company was granted authority to purchase from the Northern Electric Railway Company, one-half interest in certain tracks in Sacramento, for the sum of $11,403.

A decision was rendered authorizing the Home Telephone Company of Covina to issue $90,000 of bonds for the purpose of discharging indebtedness and making improvements.

TRADE NOTES.

The Fort Wayne Electric Works of the General Electric Company have sold 1200 meters to the city of Seattle.

The Northern Electric & Manufacturing Company has opened a branch office in Victoria, B. C. Mr. A. C. Routh is in charge.

A. Forsyth, proprietor of the Forsyth Electric Company, Seattle, announces the sale of 40 motors this month ranging from ½ to 40 h.p.

Davis & Hull, Tacoma, have been awarded the contract for installing 10 additional motors in the new furniture factory of F. S. Harmon & Company in that city.

Evans-Dickson Company, Tacoma have been awarded the contract for installing electrical equipment in the Swiss society hall and is also drawing plans for a small concrete dam for a hydroelectric unit to be installed at Morton, Washington.

The General Electric Construction Company, San Francisco, has been awarded the contract for wiring the building at Fourth and Jessie streets, for Mary Phelan, for the sum of $3600. The same firm has also been awarded the contract for wiring the garage at Van Ness and Geary street for the sum of $3300.

The Canadian General Electric Company has been awarded a contract to furnish a generator for the West Kootenay Power & Lighting Company of Rossland, B. C., part of a 7500 k.v.a. installation of a water-wheel driven generator. The water-wheel contract went to the Canadian Allis-Chalmers Company. It is understood that the increase in the generating capacity of the West Kootenay Power & Lighting Company has been undertaken in anticipation of the Canadian Pacific Railway Company electrification between Rossland and Castlegar. The contract for the electrification of this section was awarded a short time ago to the Canadian General Electric Company.

The Central Electric Company has been awarded the decorating work for the Portola Festival for about $20,000. This decoration will be different from any yet seen in San Francisco. Instead of having lights festooned across the street, 100 25 watt Mazda lamps will be festooned around each trolley pole and a large plaster of paris basket filled with flowers will give a most beautiful effect. At Third and Market streets a large bell with different colored lights will be hung. The lamps connected in such a manner as to have the bell continually rotating. At Union Square a large electric fountain will be installed. Festoons will be hung at the intersection of the streets throughout the downtown district. It will probably be the first decoration of any large size to be entirely equipped with Mazda lamps; about 30,000 25 and 40 watt lamps being used.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

REQUIREMENTS FOR ELECTRIC LIGHT AND POWER SERVICE AT PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

The Division of Works of the Panama-Pacific International Exposition to be held at San Francisco in 1915 is gratuitously distributing a handbook of rules and regulations from which the following is taken:

The Exposition Company will install a system of mains for the distribution of electric light and power to all buildings and structures on the exposition grounds and will supply the following kinds of service:

In the exposition buildings the lighting will be served from 60-cycle, three-phase mains having a voltage of approximately 115 between conductors. The lighting elsewhere will be served from 60-cycle, single-phase, 3-wire mains having a voltage of approximately 115 to neutral and 230 between outside conductors. Before ordering lamps consumers should ascertain from the electrical department the exact voltage at which current will be delivered to their service wires.

In the exposition buildings there will be available for power purposes 60-cycle, single-phase and three-phase current at an approximate voltage of 230. The power service elsewhere will be three-phase at 230 volts and single-phase at 230 volts and 115 volts. Single-phase motors must not be over 1 h.p. in size if served at 115 volts nor over 5 h.p. if served at 230 volts.

Direct current at approximately 125 and 250 volts will be available in the Machinery, Mining, Transportation and Manufactures Buildings only. Direct current will only be available during the hours that the exposition buildings are open to the public, and will be supplied for only such purposes as absolutely require the use of direct current. No direct current will be furnished for motors or apparatus of larger capacity than 25 h.p. and no motor larger than 2 h.p. will be served with 125 d.c., unless arranged for in advance under special contract.

All buildings or structures erected by or for participants in which electric service is desired, or required by the director of works, shall have installed and connected to the exposition's mains, by and at the expense of the owner or occupant, such electric wiring as is required by the director of works. All drawings, plans and specifications for electric wiring to be installed by or for participants, shall be submitted to and approved by the director of works and done under his direction, as hereinbefore outlined. All lamps, motors, and appliances shall be shown in the plans with their rated capacity indicated.

Application for an electrical construction permit shall be filed with the director of works in writing on the printed form furnished, together with plans and specifications in duplicate, describing the proposed wiring, apparatus or fixtures. Construction charges are as follows and shall be paid by the participant's contractor:

The charge for each permit granted will be $2.00, payable when permit is issued.

Inspection of all electrical construction and apparatus will be made by authorized representatives of the division of works, and the fee for inspection will be as follows, and shall be paid when final certificate of inspection is issued:

1. For lamps, heating appliances and all apparatus or devices, except motors and generators, $1.00 per kw. of connected load.
2. For motors and generators—
   1 kw. and under, 50c each.
   Over 1 kw. and up to 15 kw., $1.00 each.
   15 kw. and over, $2.00 each.

Minimum fee for any inspection, $1.00.

When more than two inspectors of any installation or part thereof are necessary, additional fees will be charged at the rate of 75c per hour for the time required by the inspector to make additional inspection.

For consumers located in the exposition buildings, concessions district or other location where the mains are not underground, the charge for furnishing and installing meter, making connections within the consumer's service cabinet and connecting the consumer's service wires to the exposition mains, will be $15.00 for each service. For flat rate consumers, the charge for making connection within the consumer's service cabinet and to the exposition's mains will be $5.00 per service. These charges are payable when permit is issued. For consumers served from the exposition's underground system, the charge for furnishing and installing meter, making connection within the consumer's service box and connecting the consumer's cable to the exposition's underground system will be $25.00, payable when the permit is issued. For flat-rate consumers the charge for connecting the consumer's cable to the exposition's underground mains will be $15.00, payable when permit is issued.

The owner or consumer shall at his own expense run service wires from his service cabinet to the exposition's mains at the point designated in his permit and install all wiring, conduits, switches and other appurtenances required for the service, complete and ready for final connection to the exposition's mains. All work done and all material used shall be subject to the inspection and approval of the director of works or his authorized representative.

Actual connection to the exposition's mains and connections within the service cabinets shall be made only by the exposition. If underground, the service leads shall not be covered up until passed by an authorized electrical inspector.

All electrical wiring done by consumers shall comply in every respect with the "Rules and Requirements" of the National Board of Fire Underwriters in force at the time the work is done; with the requirements herein and with such additional rules and requirements as may be made by the exposition. In case of dispute as to the interpretation of rules and requirements, or as to approval of work or materials, the decision of an authorized representative of the Board of Fire Underwriters of the Pacific shall be final.

The consumer shall install, where directed, a service cabinet of design and construction approved by the director of works, and install therein service fuses of the capacity and type designated in his permit. The consumer shall run his service wires from the point designated in his permit to his service cabinet in conduits or use armored cable. The consumer shall install on his distribution board a main service switch with suitable fuses and run his wires, therefrom into the said service cabinet, leaving sufficient spare lengths to enable the exposition to make the necessary connections within the service cabinet.

Service cabinets for consumers purchasing energy through a meter may be made to enclose the fuses, meters and accessories, or the service fuses may be placed in a box separate from the meter and accessories, in which case a metal covering for the connection between the fuse box and meter box shall be provided. In all forms of construction the arrangement must be such that the fuses and meter box can be separately sealed, and the meter read without breaking the meter box seal. The consumer shall provide sufficient space and fastening within the service or meter box for the exposition meter and accessories and shall bring all necessary wiring into the box.

(To be continued.)

INDUSTRIAL

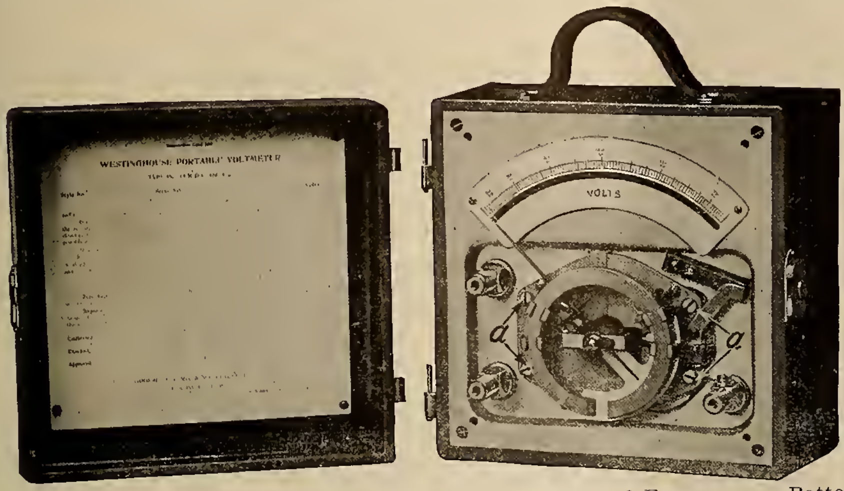
PORTABLE A.C.—D.C. METERS.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just introduced a line of high grade direct-reading instruments for general testing and laboratory work where especially high accuracy is desired, particularly on alternating current. The type PC volt-meters and watt-meters operate on the moving coil principle. The perfectly damped character of the indications enables readings to be taken quickly and accurately, and makes these meters very desirable in measuring fluctuating loads.

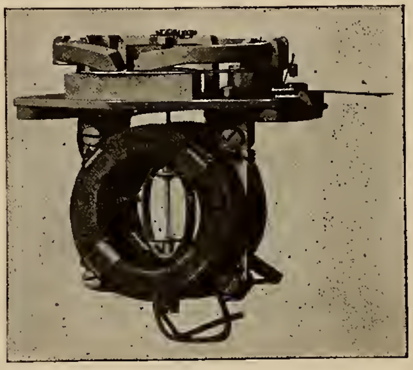
The fundamental advantages of moving coil meters are the high accuracy attainable and the fact that they can be used on either direct or alternating current circuits. The meters attain their highest accuracy on alternating current, and are free from temperature, frequency and wave shape errors. On direct current, the meter may be subject to slight errors due to residual magnetism of the laminated iron shield, but this can be entirely eliminated by taking the average of reversed readings.

A contact switch operated by a button on the front of the instrument is provided on each voltmeter. The voltmeters are entirely self-contained, all necessary resistors to obtain the calibrated scale readings being contained in the case, which is well ventilated.

The wattmeters are also entirely self-contained, all resistors necessary for the rated voltage ranges being contained in the case. The wattmeters that have double current or double voltage range are provided with a switch operated by a knob on the face-plate, which makes the proper series or series-parallel connection of coils when the knob is turned to the proper position. Only two current and two voltage binding posts are, therefore, necessary.

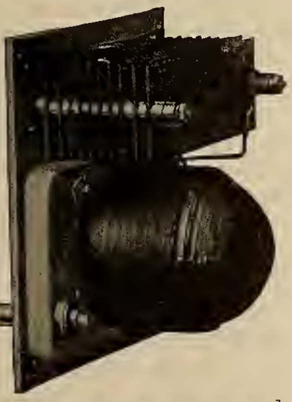


Damping Mechanism Exposed by Removal of Face Plate.



Bottom View, Showing Electrodynamometer Coils.

The movement is mounted as a unit and can be removed complete after taking off the face-plate, which makes a dust-proof joint with an inner aluminum mounting plate. The meters have a laminated iron shield riveted to the aluminum mounting plate, protecting the movement both from dust and from stray magnetic fields. The weight of the moving element is in all cases low, preserving the pivot jewels from wear, and the torque is relatively high. The pointer is of U section, to secure great strength with minimum weight. The moving element is not light enough to be delicate, yet not heavy enough to injure the jewels during shipment, or to produce wear in use. The weight of the moving element is less than 5 grams.



Back View, Showing Resistance and Iron Shield.

NEW CATALOGUES.

Handbook FL from the Electric Storage Battery Company is concerned with "Hyray" Batteries for Low Voltage Isolated Electric Plants, giving prices and capacities.

Chicago Pneumatic Tool Company is distributing Bulletin E-39 on Duntley Portable Electric Grinders for heavy duty. Bulletin 34B deals with Chicago Pneumatic Driven Compressors.

Small Motors No. 16 issued by the Industrial & Power Department of the Westinghouse Electric & Manufacturing Company has just made its appearance. This issue is devoted to the subject of electric motor driven washing machines. Electrical Equipments for Automobiles and Garages is the title of a small pamphlet (folder 4223) issued by the company to describe the Westinghouse 6-volt, single wire, starting, lighting and ignition systems developed by that company. Westinghouse Three-Inch Meters is the title of a little pamphlet (4254) describing the different meters having an overall dimension as indicated in the title. These meters are adapted for automobile battery equipments. Type CS Squirrel Cage Induction Motors for constant speed service are fully described and illustrated in descriptive leaflet No. 2321.

NEWS NOTES

INCORPORATIONS.

GLENDIVE, MONT.—The Pioneer Telephone Company has been incorporated for $40,000 to build lines in Dawson county.

SALEM, ORE.—The West Stayton Power & Railway Company has been incorporated for $100,000 by S. N. Arnold, E. D. Stedler and Grant Thomas.

ILLUMINATION.

IDAHO FALLS, IDAHO.—An addition of two 750 horsepower units is being planned for the city plant here.

PLACENTIA, CAL.—An election will be held September 10th for the purpose of determining the question of the formation of Placentia Lighting District of Orange county.

VANCOUVER, B. C.—Point Grey, a municipality suburban to Vancouver, has appropriated $500 to secure the services of an engineer to report on the cost of a municipal lighting plant.

SAN FRANCISCO, CAL.—Rousseau & Rousseau, architects, will receive bids until September 10 for the electrical installations in the Portola Realty Company's $90,000 apartment house.

TACOMA, WASH.—Bids will be called for in a few days by the Evans-Dickson Company, electrical engineers, for a hydroelectric plant for the town of Eatonville. At a recent election the voters authorized $12,000 in bonds to pay for the system.

LARAMIE, WYO.—L. L. Nunn of New York, who was formerly president and general manager of the Telluride Power Company before its sale to the Utah Power & Light Company, has applied to the Caspar town council for an electric lighting franchise, and proposes to install a plant sufficiently large to supply an electric street railway system.

JEROME, ARIZ.—Upper Verde Utilities Company has made application to the corporation commission for a certificate of convenience, and for permission to issue $130,000 worth of stock, to raise funds for furtherance of its work. The company is headed by officials of Clark interests in this district. The company will take over the water and light systems in Jerome and Clarkdale, and will install sewer system in both cities.

SAN DIEGO, CAL.—Plans for illumination of almost the entire business section of the city by ornamental cluster of lights have been completed in the city engineer's office. Five-light cluster lamps will be installed from State to Sixteenth street, on H street, at a probable cost of $19,000. From Columbia to Ninth street, same style lamps will be installed, at a cost of $11,500. The city engineers' office has called for bids for the installation of these lights.

EPHRAIM, UTAH.—A the last meeting of the city council it was decided to grant the request of the citizens for an all-day electric power service, and hereafter consumers will have this advantage. It was found that so many customers were using electric motors on washing machines and other equipment, and electric irons, fans, and similar appliances, that they could no longer be denied the convenience of their use whenever necessity required.

OGDEN, UTAH.—A proposition to extend the "White Way" lighting on a limited scale from Adams avenue to Harrison avenue on Twenty-fifth street, and on Jefferson avenue from Twenty-fifth to Twenty-seventh street, is being discussed, and President Rowe of the Weber Club expects to have the proposition in such a shape within a few days that it can be submitted to the city commission for consideration. The plans for the construction of the extended lighting system are similar to those under which the present white way lighting was installed. The city, the Ogden Rapid Transit Company, and the Utah Power & Light Company will stand the greater part of the expense. A small sum must be contributed by the property holders on the streets lighted.

MARICOPA, CAL.—What is to be a large gas compressor and pumping plant has been started by the Midway Gas Company on property recently acquired by it about one mile east of Signa Station. The plant will contain all of the latest model compressors and pumping machinery for putting a pressure on its main gas lines to Los Angeles. The excavations for the first engine room has been nearly completed. This will be filled to the level of the earth with concrete to form a foundation for the heavy pumps and compressors. Another is to be started within a few days which will be 400x50 ft. and 4 ft. deep. It will also be filled with concrete and will be used for machinery. A large cooling pond will be dug and the walls and bottom will be made of cement. The plant will cost over $700,000 when completed.

TRANSMISSION.

LA PINE, ORE.—Word has been received from the Pringle Falls Electric Power & Water Company in Portland that within 30 days a force of men will begin development work. It is expected that within the next 18 months the falls will be fully developed. The power site is six miles northwest of La Pine.

LOS ANGELES, CAL.—An ordinance adopted by the city council, approves the resolution of the board of public service commission of Los Angeles, providing for the sale of the surplus electric power produced by electric plants of said city, and not required for use in the city limits, to consumers in the county of Inyo, and fixing rates to be charged therefor.

GRASS VALLEY, CAL.—Arrangements are being made to build an electric plant for furnishing power for the Birchville mine near Graniteville. It is proposed to construct a modern power plant, which will be adequate for running the Birchville on an as extensive scale as may be desired and the new proposition will mean much to the Graniteville district.

SEATTLE, WASH.—J. D. Ross, superintendent of the Seattle city lighting department has taken the stand that the city of Seattle should build a transmission line between Seattle and Tacoma to connect with the municipal power plant of that city at an approximate cost of $100,000. This would enable the city to purchase enough electricity from Tacoma to enter into more active competition with the Puget Sound Traction, Light & Power Company.

LAKE TAHOE, CAL.—After more than three years' litigation in the courts of California and Nevada, work has commenced again upon the big dam of the Truckee River General Electric Company, where the Truckee River emerges from Lake Tahoe. Most of the legal difficulties have been overcome. A large force of men started work upon the uncompleted dam last week. Double shifts are being worked, and it is expected that the dam will be completed before winter. Work on the structure was commenced in 1909, and when the work was half completed objection was made to further construction on the ground that the dam would reduce the surface of the lake over six feet. It has now been proven that the dam will not affect the lake level. The work is being resumed by the Stone & Webster Construction Company. The dam is 30 ft. high with a width of 250 ft., and is of the gravity sectional concrete type.

BURNEY FALLS, CAL.—A project for the development of the northern parts of Shasta, Modoc and Lassen counties was presented before Commissioner Loveland at the hearing of the application of the Pitt River Power Company for permission to operate a power system from an installation at Burney Falls. The company contemplates building a plant to generate 1000 h.p., subsequently to be expanded into a larger system. An application to issue 1325 shares of preferred stock to finance the construction was deferred until the company's charter, which provides only for common stock, can be amended. The directorate comprises Dr. Wm. F. Blake, ex-Governor W. T. Jeter, Judge J. H. Logan and John F. Sheehan Jr. Commissioner Loveland also heard the application of E. M. Wilson, Nettie B. Harris and Lawrence A. Wilson for a certificate to operate a small power plant in a portion of Modoc county covered by the Pitt River application.

TRANSPORTATION.

REDONDO BEACH, CAL.—A franchise for wharf No. 1 has been sold to the Pacific Electric Railway Company by the city council.

SEATTLE, WASH.—General Manager L. H. Bean states that the installation of a $60,000 electric block system on the line of the Puget Sound Electric Railway between Seattle and Tacoma is to be started at once. Elimination of all rough places in the track will also be started at the same time.

LOS ANGELES, CAL.—Seeking to prevent the Los Angeles Railway Company from building a car barn on West Washington street, citizens residing west of Main street, between Sixteenth and 24th streets, have organized the West Washington Street Improvement Association to fight the proposed plan.

SAN FRANCISCO, CAL.—Interest on the $1,100,000 note issue of the Oakland Terminal Railway Company, secured by trust deed to tide lands formerly owned by the Key Route, has been paid by the San Francisco-Oakland Terminal Company, which, as the holding company, guaranteed the note issue. An extension of one year was asked and will probably be granted for the payment of principal.

SEATTLE, WASH.—The receivers for the Seattle, Renton & Southern Railway Company, a line nine miles long partly within and partly without the city limits of Seattle have rejected the offer of the city to purchase the entire line for $1,200,000 for the reason that the attempt on the part of the city to take over that part of the road beyond its limits would be illegal and because the sum offered is not adequate.

PHOENIX, ARIZ.—City Attorney Prescott has reported to the council that under the franchise granted the Phoenix Railway Company the council could require them either to pave their tracks on Second avenue or to remove their tracks off the street, and that in case the company refused to do either, the city could declare the franchise void for a noncompliance with part of it, and proceed to remove the tracks from the streets. The city council will meet this week to consider the matter further, and it is quite likely that an amicable settlement will be concluded.

SAN JOSE, CAL.—F. E. Chapin, vice-president and general manager of the Peninsular railway, with headquarters in San Jose, has been in conference with Paul Shoup, in charge of electric interurban service for the Southern Pacific relative to Peninsular service between Los Gatos and San Francisco. It is planned to operate trolley cars over the Southern Pacific tracks between Los Gatos and Palo Alto and to give a direct night service to San Francisco, beginning about September 15. When the steam road changes from its summer to its winter schedule, the Peninsular railway will take over the line operated by the Southern Pacific between Los Gatos and Palo Alto and operate it electrically.

TELEPHONE AND TELEGRAPH.

VANCOUVER, B. C.—The British Columbia Telephone Company of Vancouver have completed plans for the erection of a new telephone exchange in Coquitlam.

CLOUDCROFT, N. M.—It is expected that the telephone line to connect Cloudcroft with Mayhill will be completed in a short time. The line will have connections with Bell phones in Cloudcroft and long distance.

NOGALES, ARIZ.—P. C. Gittins, district manager of the Mountain States Telephone & Telegraph Company, states that long promised installation of a new telephone plant in this city will be begun in a short time.

NEVADA CITY, CAL.—The Pacific Telephone & Telegraph Company has started to rebuild the telephone line from Camptonville to Sattley, a distance of 42 miles. The new line will run from Camptonville to Alleghany and Forest City, Downieville, Goodyears Bar, Sierra City and Sattley, with other stations en route.

SAN FRANCISCO, CAL.—Chairman Alex. Vogelsang the supervisors public utilities committee, suggested at a recent meeting that City Attorney Long be authorized to enter into negotiations with the Pacific Telephone & Telegraph Company along the lines heretofore proposed for reaching a compromise between the city and the corporation. Under this the city could cease attacking the merger of the Pacific and Home companies on condition that both systems be operated hereafter under the terms of the Home franchice relating to the payment to the city of a percentage on the gross receipts. Such an arrangement would mean $60,000 a year for the city, whereas, under the terms of the Pacific franchise, no percentage is paid. The matter was laid over for a week.

WATERWORKS.

PRIEST RIVER, IDAHO.—Bonds in the sum of $14,000 have been voted for the construction of a water system.

KOOSKIA, IDAHO.—At a special election held here bonds to the amount of $10,500 were authorized for the purposes of constructing a modern water system for the town.

VANCOUVER, B. C.—For a water supply for West Vancouver, Municipal Engineer Carter is applying to the City of Vancouver for one cubic foot a second, or at least ¾ of a cubic foot a second by tapping the Capilano system.

SAWTELLE, CAL.—Citizens of Sawtelle are making a protest against sale of franchise to lay water pipes in streets of Sawtelle stating that such sale will hamper and delay the establishment of municipal water works by which to carry Owens River water to consumers.

LOS ANGELES, CAL.—Annexation of Arlington Heights to Los Angeles is advocated, the Arlington Heights Boulevard Improvement Association being behind the plan. E. W. Grannis, secretary of the association, stated that the chief object of this move is to procure water from Franklin canyon, through aqueduct project.

SAN FRANCISCO, CAL.—The Judge Advocate of the Western Department of the U. S. Army has taken possession of Lobos Creek, the source of water supply for the Presidio and for Fort Mason, under section 1416 of the Revised Statutes, Civil Code, State of California, which gives a water user the privilege of appropriating a water supply pending the settlement of any controversy over ownership, and so has put up to the Spring Valley Water Company, the duty of showing what claim it has to the title to half of the creek. The decisive move was announced a the Judge Advocate's office to be necessary at this time to protect the interests of the United States, and, as a first step toward settling once and for all time the controversy as to whether or not the Federal Government can secure title to the creek without paying an exorbitant amount of money for the right to use the water flow exclusively.

ALPHABETICAL INDEX TO ADVERTISERS

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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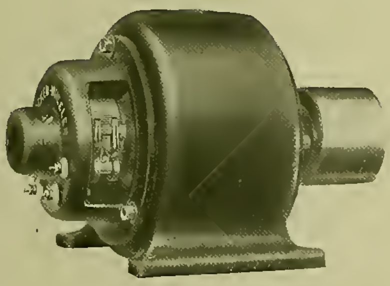
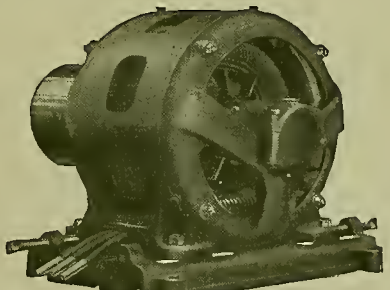
Crocker-Wheeler Stock Motors

For Prompt Shipment



Form L D. C. Motor



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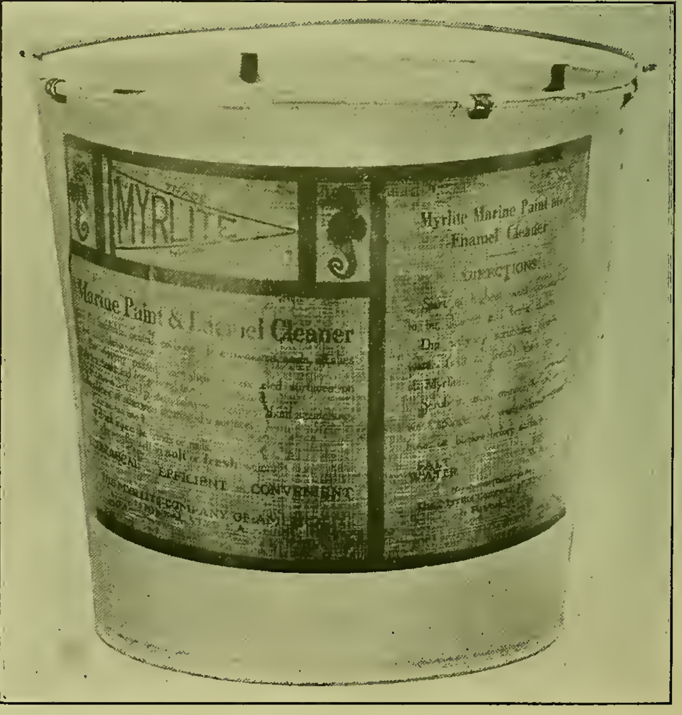

JOURNAL OF ELECTRICITY
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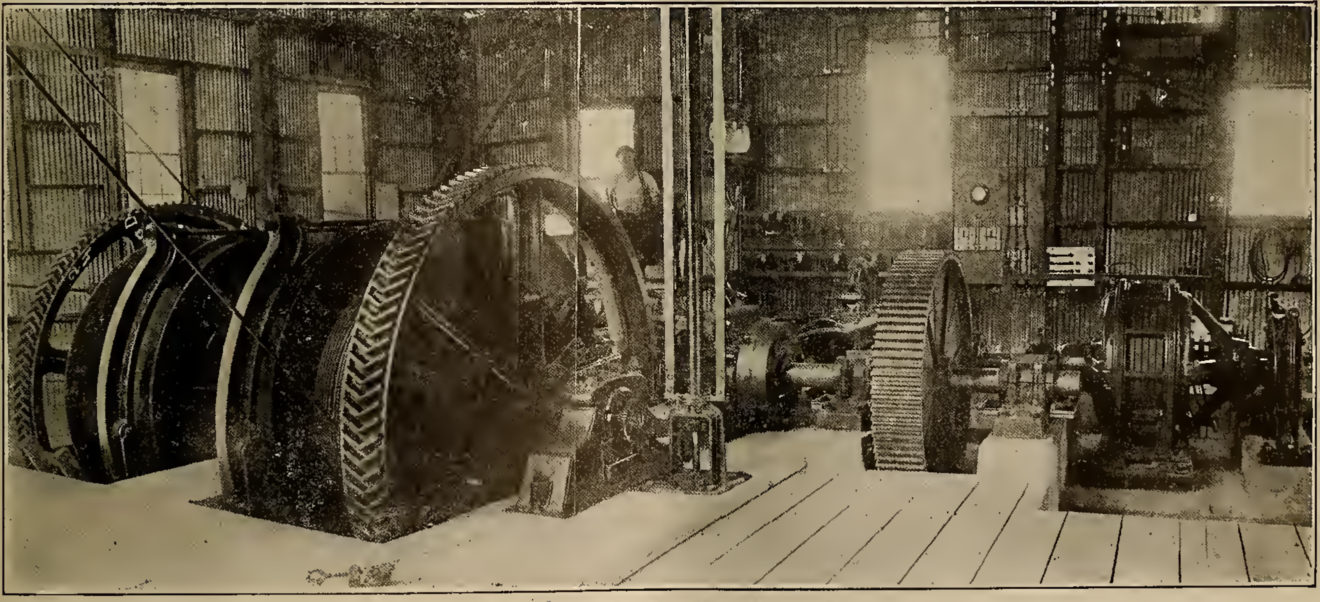
ELECTRIC HOISTING ON THE MOTHER LODE

BY M. M. BOGGESS.

In the past two or three years, the mine operators along the Mother Lode in California have awakened to the possibilities of electric drive in connection with hoists. This has been brought about principally by the success of electrically driven mills, compressors, pumps and blowers, which demonstrated that the electric motor was an efficient, reliable, compact and cheap power, requiring little expense for maintenace.

Not only is the electric service reliable, but it is less expensive than any other power which is available in this particular section. The cheapness of the power, together with the lower first cost of the motor, is such that practically all of the new installations are electrically driven, while a great many of the older ones have found it wise to abandon their former methods and install electric power.

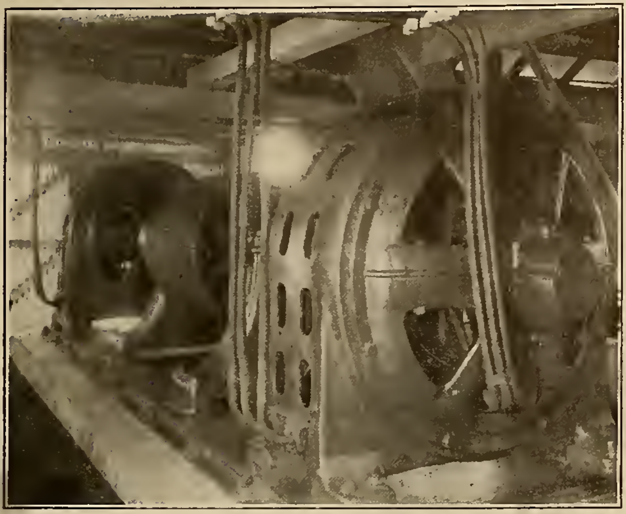


Electric Hoist at Lightner Mine.

The power companies deserve much credit for this awakening, due to their unceasing attempts to render reliable, continuous service. This has been accomplished by arranging the switching apparatus to tie in with several of their various stations. In the event of any trouble to the station supplying a certain load, it only requires a few seconds' time to switch over to one of the others, and the service is practically uninterrupted. This reliability of service was essential before the electric hoist could be installed, as it is the main artery of the mine, and the only way by which the men underground can reach the surface, in case of necessity.

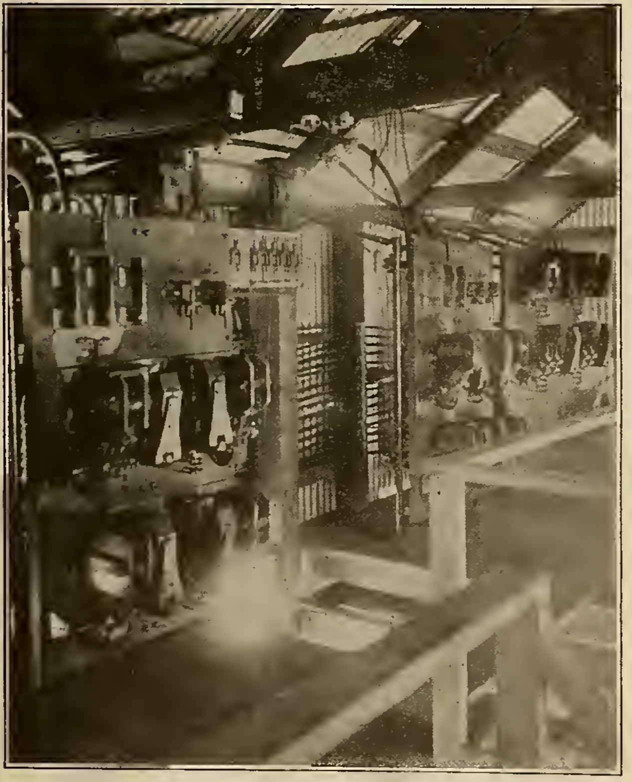
The largest electric hoist in California is at the South Eureka Mine, near Sutter Creek. This consists of two General Electric 400 h.p., 450 r.p.m., variable speed slip ring type motors, mounted on a common base, with a rope sheave between them. The other sheave is mounted on the pinion shaft to which the hoist drums are geared. The hoist is of the jaw clutch type, with post brakes, and was originally driven by a steam engine, having one cylinder on each side. This is shown by the illustration which also shows the ease with which electric drive may be applied to steam driven hoists. In this case the connection rod of the steam engine was removed, and a new

shaft pressed into the pinions, with an extension long enough to permit of a rope sheave at one end. The motors are controlled from the engineer's platform by means of a master controller, which operates two



South Eureka Hoist Motors.

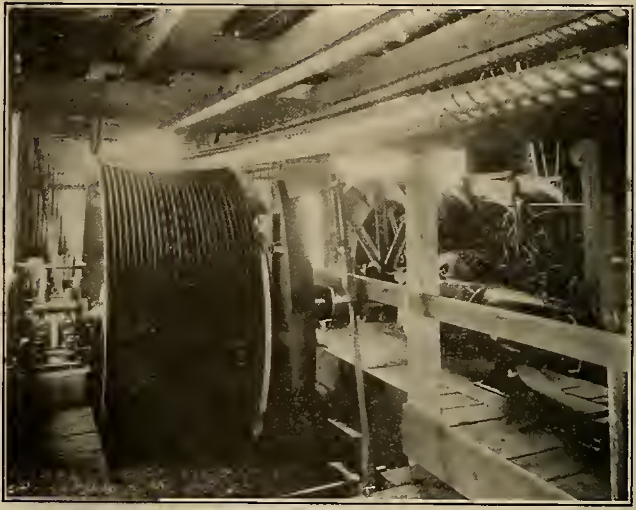
primary and secondary current-limit magnetic contactor panels, one for each motor. In the illustration of this equipment two primary panels are shown, only one secondary being shown, the other secondary being exactly the same as the one illustrated.



Control Equipment at South Eureka Mine.

The circuits of the primary and secondary currents of these motors are made and broken on the panels, so only the low amperes required for magnetizing the contactor coils pass through the master controller operated by the hoist man.

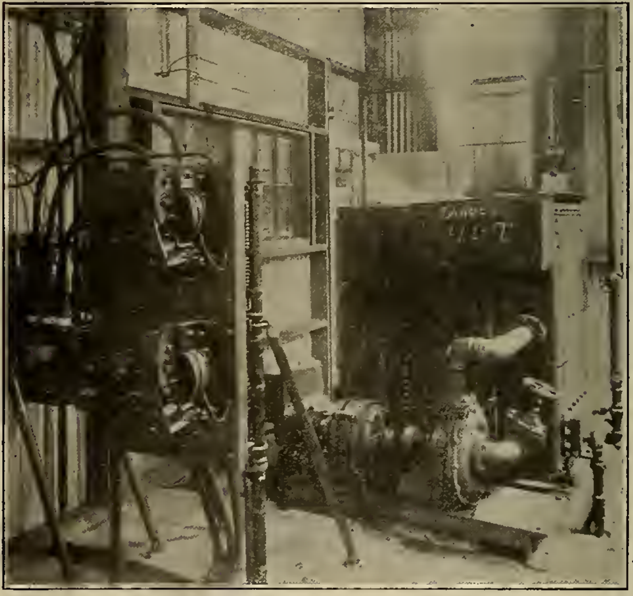
The hoist has two drums, and generally operates in counter-balance, although the motors are designed to take care of the load when out of balance. The rope speed is 1200 to 1300 ft. per minute, and the total load, including cable with the loaded skip at the bottom of the shaft, is approximately 18,000 lb. The shaft is about 2700 ft. deep, with a slope of 65 degrees.



South Eureka Hoist Showing Change from Steam to Electric Drive.

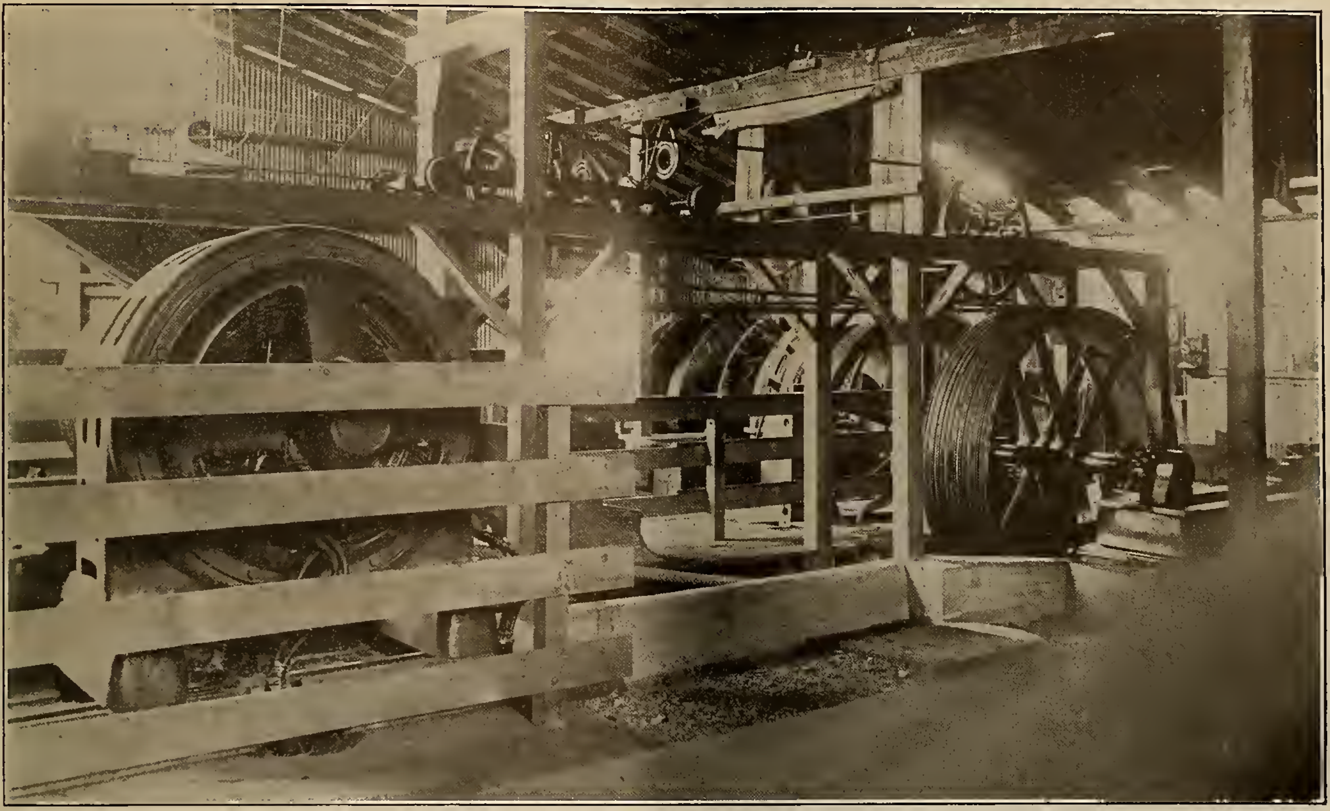
The cost of power has been reduced between 60 and 65 per cent, and the electric installation paid for itself in about a year, due to this great reduction.

The Keystone Mine, at Amador City has recently installed a 300 h.p., 450 r.p.m., variable speed General Electric induction motor and liquid rheostat control. This motor also replaces a steam engine, and in the first few months of operation has shown a saving of over 65 per cent in power. The motor is connected with the pinion shaft by means of a rope drive. The

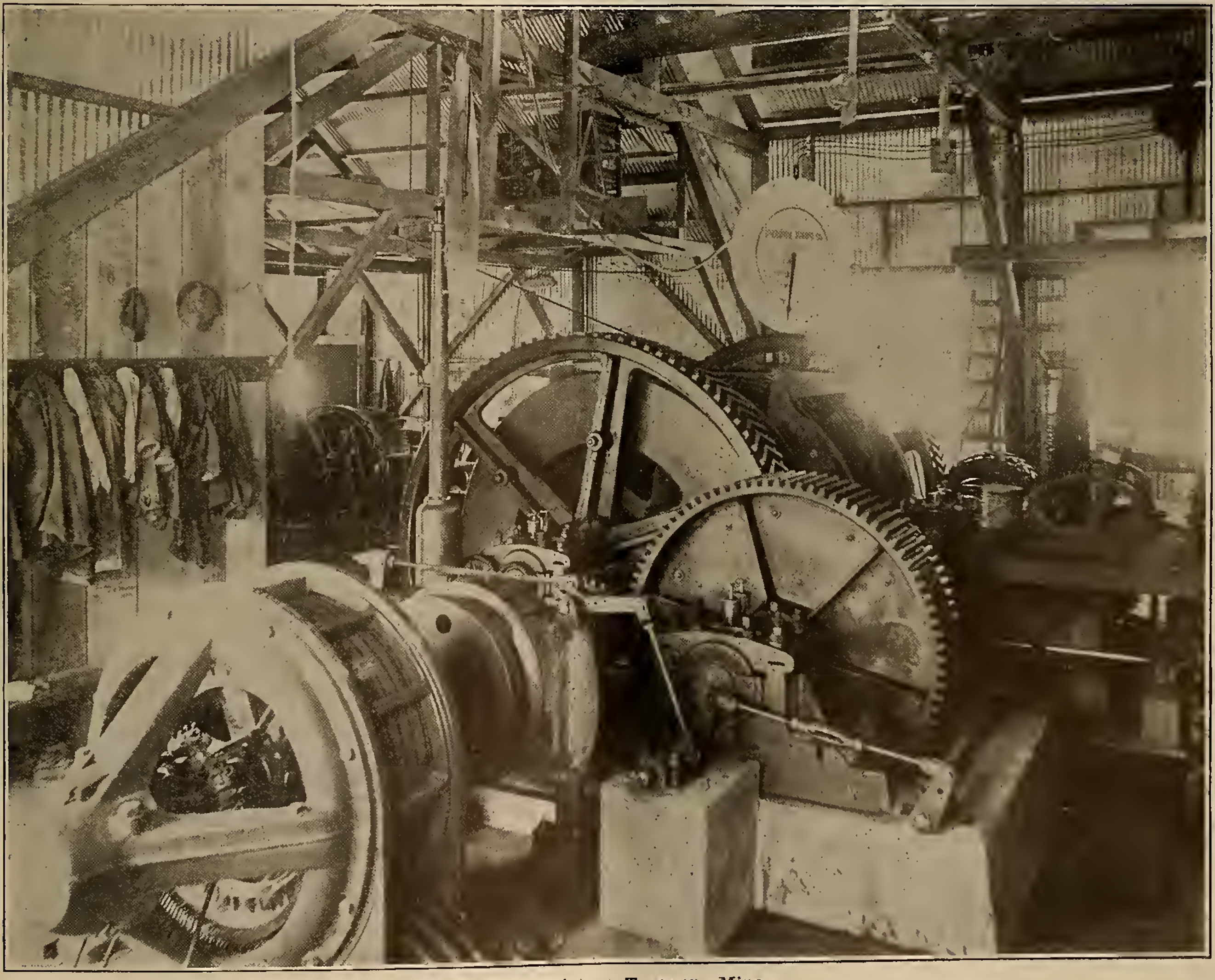


Control Equipment, Keystone Mine.

liquid rheostat control is in a separate room directly behind the engineer's stand. This rheostat is in the rotor circuit of the motor, and is used for varying the speed, while the magnetic contactors are used for opening and closing the primary circuit. The lever raising and lowering the weir which determines the height of the water on the rheostat plates, and consequently the motor speed, also operates the master con-



Electric Motor and Hoist at Keystone Mine.

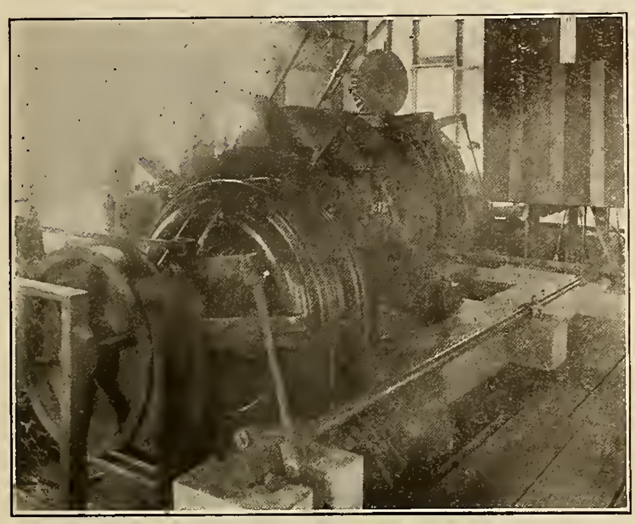


Electric Hoist at Treasure Mine.

troller, which closes the magnetizing circuit for operating the primary contactors.

This hoist has a load of about 14,500 lbs., including rope and loaded skip at the bottom of the shaft; the hoist speed is 700 ft. per minute; the shaft is 2600 ft. deep, and has a slope of approximately 52 degrees to the horizontal.

The hoist equipment at the Treasure Mine near Amador City consists of a 200 h.p., 600 r.p.m. variable speed General Electric motor, geared through a double reduction of gears to a double drum hoist of the jaw clutch and post brake type. The secondary of the drum controller is connected across the secondary of the motor and the resistance, while the primary fingers act as a master controller for operating a magnetic contactor panel. This arrangement does away with any arcing directly beneath the controller handle.



Electric Hoist at Plymouth Mine.

The shaft is about 1600 ft. deep and the hoist has a total load of approximately 6000 lbs., including rope, when the loaded skip is at the bottom of the shaft, and a rope speed of 800 to 850 ft. per minute.

The equipment of the California Exploration Company at the Plymouth mine at Plymouth, consists of a General Electric 225 h.p. intermittent hoist with variable speed 600 r.p.m. motor, geared through double reduction of gears to a double drum hoist of the friction clutch type, with post brakes. The controller equipment is similar to that used at the Treasure Mine. The rope speed is approximately 700 ft. per minute; depth of shaft, 1600 ft. vertical, and total load, including rope with loaded skip at the bottom of the shaft, is approximately 8500 lbs.

The first illustration shows the hoist equipment installed at the Lightner Mine at Angels Camp. It consists of a General Electric 200 h.p. variable speed induction motor, geared through a double reduction of gears to a double drum hoist. The control equipment consists of primary and secondary contactors, the latter being of the current limit type. These are operated by a master controller on the engineer's platform, and the equipment is similar in every way to that installed at the South Eureka Mine.

Among the other more important electric hoist installations may be mentioned a 150 h.p. General Electric motor, with primary control panel, installed at the Dutch Mine near Jamestown, which has replaced a steam drive, although the same hoist is used.

The Empire mine in Grass Valley, and the Hardenburg mine, near Jackson, have installed equipments exactly similar to the one at the Dutch mine.

The only 2200-volt hoist equipment is installed at the Melones mine in Calaveras county. It consists of a General Electric 250 h.p. variable speed motor, together with contactor panels, and master controller.

The Black Oak Development Company at Soulsbyville, in Tuolumne county, have replaced a water wheel with a 1000 h.p. General Electric variable speed hoist motor, and reports more economical operation. The Harvard mine has ordered a 250 h.p. General Electric variable speed hoist motor with control panel and master controller, similar to that installed at the South Eureka mine. This installation is also replacing a steam engine.

A standard primary contactor panel has been developed for use on hoist motors ranging from 100 to 200 h.p. It consists of overload relays, primary switch, and primary contactors. It is hardly necessary to install equipment so elaborate as those illustrated for the South Eureka and Lightner mines with these smaller motors, but it is desirable to do away with the breaking of the primary current on the controller fingers, the attendant care, and the arcing directly under the controller handle. It is for this reason these panels were installed, and found immediate favor at the Empire, Plymouth, Hardenburg and Dutch mines.

All the motors referred to above, with the exception of the one at the Plymouth mine, are rated according to their continuous horsepower, whereas the general practice in Europe is to rate hoist motors at least 25 per cent above their continuous horsepower, thus showing the conservatism of the American manufacturers.

It is gratifying to note the almost universal adoption of the electric drive in this section, and due to the peculiar conditions favorable to electric hoist, it is only a question of a few years before the steam and water driven hoists will be as uncommon as was the electric hoist three or four years ago.

Suit against the Forest Service of the U. S. Department of Agriculture has been filed in the U. S. District Court at San Francisco by the Pacific Gas and Electric Company, asking that forestry officials be restrained from preventing the company from effecting certain improvements on its property adjoining the Tahoe National Forest and that the company be allowed to build an aqueduct over a corner of the forest reserve. The Secretary of Agriculture and the forest officials object to the elevation of the Lake Spaulding reservoir because, they assert, the water will overflow parts of the Tahoe National Forest, and are also opposed to the construction of the proposed aqueduct through a section of the forest reserve. The plaintiff holds that the Tahoe National Forest is a State property, over which the United States Government has no jurisdiction whatever.

HYDRAULICS—III.

BY OTTO B. GOLDMAN.

Irrigation Organization.

Making no pretense at presenting this series in logical sequence, we will at this time take up the matter of irrigation organization. Time was, when the engineer's duties were limited to the solution of the technical problems involved. Now he is called upon to solve the problems of organization, and to devise the entire system and organization so as to take advantage of the peculiarities of human nature. For the system must not only be mechanically operative, but must, above all, be financially successful. We not only want the highest efficiency of our plant, but also the maximum duty of our water, so that the whole can be shown to be a good investment. That is the measure of its worth. In other words our problem is to devise a system that will use as little water as possible and get it as cheaply as possible. Our equipment must then be efficient, our system such as to promote economy, and our organization such as to obtain the necessary funds cheaply. The usual forms adopted are (1) governmental, (2) Cary act and (3) association. The governmental, whether state or national, has one big advantage, in that it can obtain the necessary funds at the least cost. It has the disadvantage of being paternal. The system is literally grafted onto the settlers without consulting them as to any of the details thereof or the limit of cost per acre that shall be maintained. They have all been entirely operative, but none that has the writer seen could be called financially successful.

The Cary act, we will have to dismiss rather abruptly. Its motive is to put in a system as cheaply as possible and charge as much as possible. Private enterprise has many admirable qualities. But there is such a thing as too much of it, as for example the "farming" of taxes in Roman days or the issuing of "letters of marque" of a century or two ago. This act is no more or less than a privateer's license. That's pure piracy. It should be abolished. Any unsuccessful system is a trade killer.

The organization in the form of an irrigation district or association combines all the advantages of private enterprise with community action and lacks only the governmental advantage of cheap funds. It suffers from what might well be called discriminate credit. However, inasmuch as the greatest wealth of a nation is in its land, why cannot the government (state or national) furnish the necessary credit to community associations properly formed? Certain limitations will of course come to mind at once and these have been included in the following outline. Immense sections of country remain undeveloped because of the high tax money places on labor and brains. The attention of the legislative branch of our government should be called to the following:

(1) That the general organization of the association remain as at present.

(2) That it employ its own engineer to devise a system for the association.

(3) That copies of the plans be transmitted to each member of the association.

(4) That sufficiently thereafter, to have given time for deliberation, a meeting be called for the purpose of discussing, criticizing and offering alterations and amendments to the plans and a date be set on which to vote on the acceptance or rejection of the plans and any alterations and amendments offered. (5) when voted upon, if plans are adopted, they be sent to the government engineering department and the chief executive for approval, and if approved then (6) the district shall issue bonds to the extent of the estimate and convey them to the government who shall then (7) issue credit to the district to the extent of the bonds and at a rate of interest sufficiently in advance of that paid by the government, to poll all expenses inherent in the rendering of the service.

(8) As soon as this credit has been obtained then the district shall advertise for sealed bids for (a) furnishing the entire equipment, (b) doing all necessary installation and construction work.

(9) That the bids be awarded to the best responsible bidder.

(10) That an annual charge be assessed against each acre in the district which shall consist of two parts, (a) one in proportion to the acre cost of maintenance, interest on indebtedness and sinking fund, and (b) one in proportion to the actual amount of water used by each member of the association.

(11) That the payment of these assessments come under the laws now governing the payment of taxes.

Further details must of course be added to complete the organization, but are not of sufficient importance to warrant taking up further space at present. Once the above proposed organization is put to life by the necessary legislation, the development of the country can proceed unhampered. The organization would have all the combined advantage of government credit, community action and the energy, efciency and initiative of private enterprise.

Very large and intricate systems usually do or rather should combine two or more of the following, viz: (1) irrigation, (2) reclamation, (3) navigation, (4) flood water control and (5) power development. These should undoubtedly be handled by the government. It may be best to turn this work over to the army engineers because of their freedom from political machinations, and because of their splendid record. It must be realized that the present organizations are not effective. Among other things, they lack health, or are they politically hampered? Let us illustrate. Along the Columbia River in Oregon the government is building the Celilo Canal. If a dam had instead been thrown across the river at that point, not only would we have obtained the more rapid navigation of open slack water, but we would have had available approximately 300,000 h.p. All this power could have been used for the irrigation of the adjoining table lands. No, we are afraid the canal is a mistake of great narrowness and many miles in length, and many many millions cost. Inevitable as the coming dawn, that canal will one day be submerged. The neglected power is too valuable to leave long unused. In a subsequent article we will take up the problems of irrigation systems from the standpoint not only of making the farm pay, but making it a desirable place to live —a home.

ELECTRICAL PUMPING AND IRRIGATION

CEMENT PIPES AND DISTRIBUTING STAND PIPES.

BY B. A. ETCHEVERRY.

In Southern California many hundreds of miles of cement pipes have been used for the distribution of water to orchards and in recent years its use has been extended to some of the orchards in Washington and Idaho. While many orchardists in Southern California still prefer the open flume, there are the following objections to its use:

1st. Teams and farm implements can not cross the flume and there is always a strip of land on each side that can only be partially cultivated because it can not be crossed in the opposite direction.

2d. The flume is liable to be damaged by the teams and farm implements.

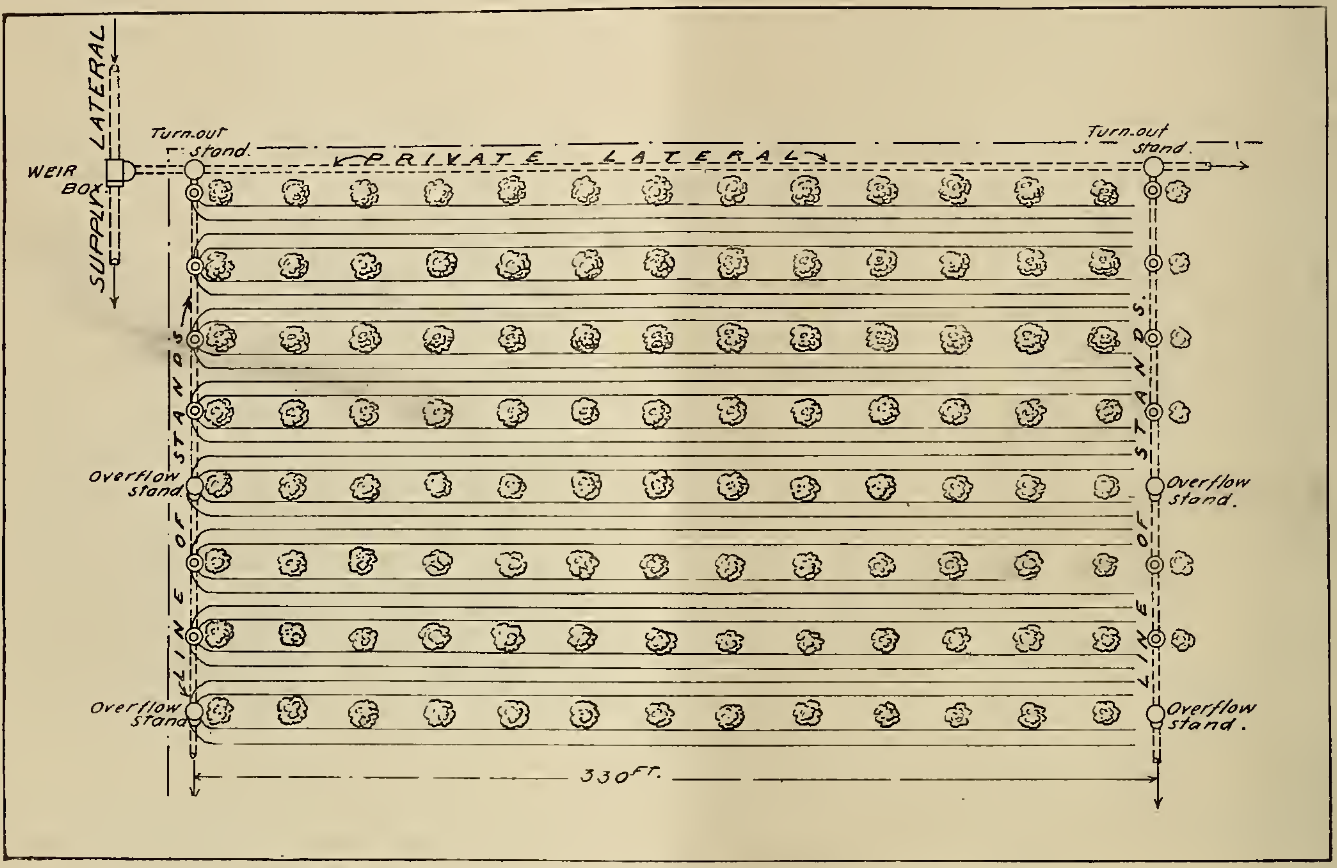
3d. The flume may settle and a crack if the earth underneath is washed away by the water passing through the spouts into the furrows.

4th. The furrows can only be made with teams and cultivators up to 15 ft. from the flume and they must be completed by hand.

5th. Leaves may fall in the flume and stop up either partially or completely the openings of the distributing spouts, which requires extra time on the part of the irrigator.

These disadvantages have led many of the orchardists to the use of underground pipes which do not interfere with cultivation. A complete underground pipe distributing system consists of:

1st. A main pipe line which carries the water from the measuring box or point of delivery to the lines of distributing stands which take the place of head ditches.



Cement Pipe System of Water Distribution for Orchard Furrow Irrigation.

Distribution of Water from Stand Pipe Into Furrows.

2d. The distributing lines which conduct the water from the main pipe line and which are connected to the distributing stands.

3d. The distributing stands or basins by means of which the water is brought to the surface and distributed into the furrows through small galvanized iron spouts inserted in the sides of the basin.

4th. Regulating boxes and accessories.

The pipe systems vary in the details of construction of the stand pipes and gates. They also vary in materials employed, some using vitrified clay pipe while most prefer cement pipes. The clay pipes are used very extensively where there is a clay pipe factory in the neighborhood. They are usually more expensive than cement pipes. In planning an underground pipe system there are some general principles which apply to all the different types.

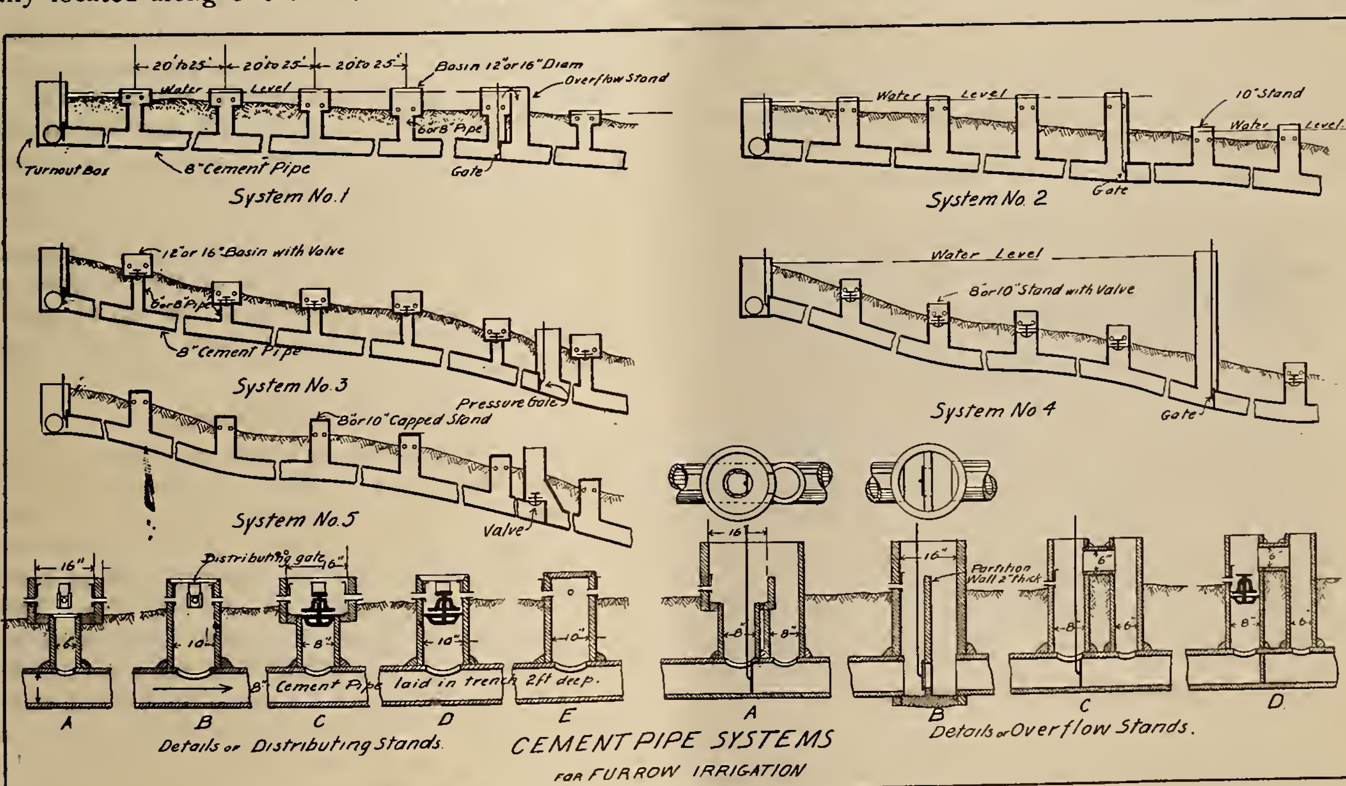
Location.

The main line which carries the water from the measuring box to each line of stands is usually placed parallel to the direction of the furrows. The branches, on which are placed the stand pipes, are run at right angles to the main line. The number of laterals depends on the size of the field and on the length of the furrows, which varies with the character of the soil. the quantity of water handled, the irrigator, etc. As a rule the distance apart of laterals should not exceed 40 rods, or 660 ft., which measures the side of a 10 acre tract. A better distribution, especially on sandy soils, can be made by using furrows 330 ft. long. The slope of the furrows varies from 1 in. to 20 in. in 100 ft. For loamy soil a fall of 8 to 12 in. in 100 ft. is to be preferred. For gravelly soil a steeper slope is often used. The main line, when parallel to the furrows, has approximately the same slope as the furrows. It is usually located along one of the boundaries of the land. The lateral or line of stands usually at right angles to the furrows may have a very steep slope. For a small tract whose width is less than 660 ft., one line of standpipes leading from the measuring box is often all that is necessary.

Different Systems and Placing of Stands.

Each stand is usually placed at the head and in line with the tree row. In this way little inconvenience is experienced in cultivating. The distance apart varies with the kind of trees; for orange orchards 20 to 25 ft. is common; for walnuts 40 to 60 ft.; for alfalfa 40 to 50 ft. There are a number of different types of stands. Some of the most common are illustrated. The methods of arranging stands and overflows or cut offs are numerous. A few typical examples of those used for orchard irrigation are given in the plate. Some of the details such as the types of stands and methods of arrangement and types of overflows have been patented and known as distinct systems.

Where the land is comparatively level and the line of stands on a flat grade the overflow system and Killar system are extensively used. For these two systems the top of the stands are placed on a level and the water rises in the stands, seeking its own level. Where the overflow system is employed the stands are seldom made over 16 in. above the ground. Where it exceeds this it is more economical to start a new section of stands by inserting a stop gate and overflow. The stop gate may be adjusted to allow part of the water to go down to the next stand. If this gate is not adjusted just right or if it is closed the water which is not distributed through the stands above passes over the overflow. On steep grade the cost is much increased because an overflow may be required at each stand. The Killar system does not provide an over-



Cement Pipe System for Furrow Irrigation.

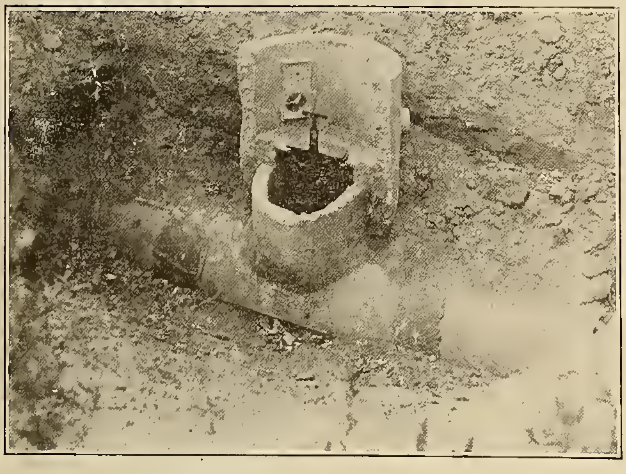
flow, the regulation of flow depending entirely on the adjustment of the stop gates. On steep grade the stands must be several feet high or a large number of stop gates used. For steep grades one of the other systems may be preferable and more economical. In the types 3, 4 and 5 the water in the pipes is under pressure and is prevented from flowing over the stand by using regulating valves or by capping the top of the stand pipe with cement mortar. The cut off gates or orerflows are placed so as to regulate the pressure head, the line being divided into sections. The sections should be not larger than 600 ft. and the pressure head should not exceed 15 ft.

Details of Stands—Construction.

The common types of cement stands are shown in detail in the accompanying drawing. Stand A consists of a section of 6 or 8 in. pipe about 12 in. long,

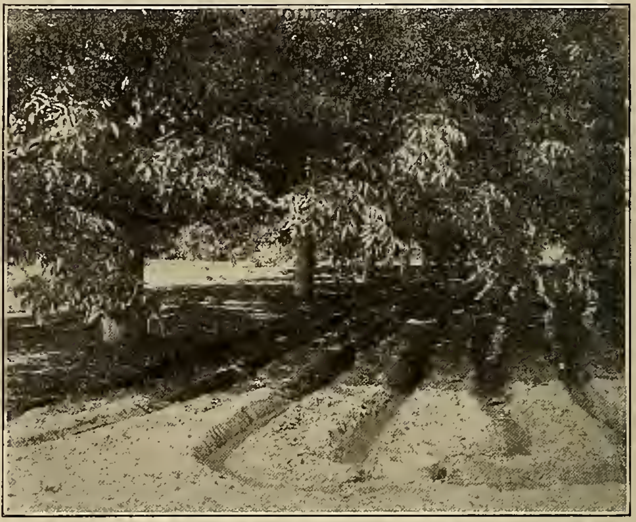
Regulating the Valve in a Stand of a Cement Pipe System.

one end of which is cut out so as to saddle over a 6 or 8 in. hole which has been cut in the pipe line with a hand pick called a tomahawk. This piece of pipe is cemented to the pipe line with a 1 : 2 cement mortar. Around the top of this pipe at the surface of the ground is placed the distributing basin and the space in the basin around the smaller pipe is filled with ordinary cement mortar. The basin consists of a cir-



Section Through Valve Stand Pipe.

cular section of 16 in. pipe 6 to 16 in. in length. Around the circumference of the basin and near the floor are from 4 to 6 galvanized iron distributing gates or spouts. These gates are set with cement mortar in holes which have been cut out as soon as the pipe has been made. If the pipe has hardened a pick or tomahawk is necessary. The water is distributed through the gates to the furrows. When the soil is such that the furrows will wash together a larger semi-circular basin is used. This basin is constructed with a special mould. Stand B consists of a single joint of 8 to 12 in. pipe cut to fit over a hole made in the distributing line. The distributing gates for the Killar system are usually placed at a given distance from the top (5 or 6 inches). Where the furrows will wash together the larger basins are better. Stands C, C_2 and D differ from stands A_1, A_2 and B in that a regulating valve is connected to the stand. Stand E consists of a single joint of pipe capped with cement. In this



Distributing Line With Distributing Basin at Head of Tree Rows.

stand the distributing galvanized iron gates are opened from the outside. With the other stands the gates or spouts may open either from the outside or inside. Other types of stands are the stands used for alfalfa irrigation by flooding. One type consists of a section of 8 or 10 in. pipe placed vertically which will regulate the flow. These stands are placed every 40 or 50 ft. Another type used where alfalfa is irrigated with pipe or hose consists of one or two sections of 8 or 10 in. pipe placed vertically, at the top of which is cemented a galvanized iron T joint. These stands are placed every 10 rods.

Overflows and Cut Offs.

Overflow A is ordinarily made of a section of 16 in. pipe in which is cut at the top an overflow 5 or 6 in. deep and 7 in. wide. Against this 16 in. pipe and cemented to it is a semi-circular or 2-3 circular section of an 8 in. pipe. Overflow B consists of an overflow 1 1-2 in. thick built in a 14 or 16 in. pipe. This can be easily constructed by pouring a wet mortar between wooden forms. Overflow C is made up of two stand pipes connected with a short piece of 6 in. pipe. In overflow D a valve is used instead of a gate. It also differs from the other overflows in that all the water must pass through the overflow.

Cut Offs or Turn Outs.

A cut off consists of a stand pipe in which one or more gates are used to regulate the quantity and direction of flow into two or more branches. If the water presses the gate against its frame, an ordinary slide gate, will be water tight. If the water pressure presses the gate away from its frame a pressure cut off gate is preferable to the ordinary slide gate which will leak. A pressure gate is a gate which through some mechanical device can be locked tight against the frame. This is usually accomplished by turning the handle which operates a lever, cam, geared wheels or other tightening device.

Accessories.

1. Galvanized iron distributing gates or spouts which are made in different weights and of different shapes, either circular or oval. The light weight gates are used where the water presses the slide against the entrance to the spout and tends to keep the gate closed. The heavier weight is used where the water presses the gate away from the spout and tends to make it leak.

Cement Pipe and Accessories for Orchard Irrigation.

2. Cut off gates or stop gates, which are usually of two types: the cast iron or steel slidegate and the pressure gates described above.

3. The valves, which vary in detail according to the manufacturer. A good valve should be easily taken apart to remove leaves or twigs which may clog the stand.

Placing of Accessories.

The galvanized iron distributing gates are placed in holes made in the distributing stands and cemented with mortar or neat cement. The holes being cut before the concrete has hardened, provided when making the pipe, or cut out with a sharp pick after the concrete has hardened. The cut-off gates and valves are cemented with mortar when placing the stands.

The attachments can be bought from the several manufacturers in Southern California at the prices given below.

Cost of Galvanized Iron Distributing Gates or Spouts.

Size, diameter, inches. Round shape.	Light weight. Cents.	Heavy weight. Cents.
1	4¾	7
1¼	5	
1½	5¼	10
2		11
Oval shape, equivalent to diameter.		
1		10
2		15

Cost of Gates.

Cast Iron Slide Gates. Diameter of opening, inches.	Price.	Cast Iron Pressure Gates. Diameter of opening, inches.	Price. (List, three manufacturers).
6	$0.75—$0.85	6	$2.25—$2.50—$3.00
8	1.05	8	3.00— 3.25— 4.25
10	1.75	10	3.50— 4.00— 5.00
12	2.50	12	4.25— 5.30— 6.00
14	3.00— 3.50	14	5.75— 7.25— 7.50
16	4.00— 4.75	16	9.50— 9.75
18	6.75	18	10.75—11.75
20	9.00	20	12.00—13.00

Cost of Regulating Valves.

No. of Valve.	Size of opening. Inches.	Price.
5	2.5	$ .70
6	2.5	.75
8	5	.85
10	6	1.10
12	8	1.50
14	10	2.50

Approximate Cost of Stands in Place.

Stand.	Price complete.
A	$1.00—$1.50
B	.90— 1.25
C	1.75— 2.00
D	1.65
E	1.00
Overflow	2.75 + slide gate

Pressure Pipe Lines and Valves.

On some of the orchards in British Columbia and also on orchards in Idaho and Southern California, the water is distributed over the orchards in high pressure, wood-banded pipe lines. The pipe lines take the place of the head ditches; they are tapped at each row or wherever desired by a standpipe formed by screwing in the wood short sections of galvanized iron pipe capped by an ordinary garden valve to regulate the flow. Where the land is very irregular and it is desired to keep the water under pressure, this form of construction is the most desirable and in fact the only feasible one, but if it is possible to break the pressure and maintain it within the safe pressures for cement pipes by proper regulation, the cement pipe distributing system has the advantages of lower cost, greater durability and better division of the water between furrows.

DECISION REGARDING SAFETY OF ELECTRIC WIRING.

The supreme court of Washington recently held in the case of R. C. White against the Reservation Electric Company that the patrons of an electric company "have the right to presume that everything that is open to touch concerning the appliances by which electricity is conveyed, can be touched with safety." While working for the company White had arranged a contrivance of his own of levers and pulleys, to throw off and on. The evidence showed, however, that the proximate cause of the injury he suffered was the fact that the wires were carrying extraordinary heavy voltage, resulting in the shocking of numerous patrons. This fact led to the general statement of the dostrine held to apply under Washington laws.

Electrification of the Canadian Pacific Railway branch between Castlegar and Rossland is proposed. Direct current from the power plant at Bonnington Falls will be used, and the trains will be operated by large electric locomotives, securing the current from overhead wires. The section of the line to be electrified is 30 miles in length and has heavy grades and numerous curves.

THE PROPER UTILIZATION OF LIGHT.[1]

BY H. E. GRANT.

As illumination is an effect of which light is the cause, it is first accessory that we consider briefly the subject of light and in this way familiarize ourselves with the terms in which the subject of illumination and glare will be later discussed.

Even the ancients were familiar with some of the laws of light. For example, that we see an object in the direction in which it lies, and that it is impossible to see around a corner—and from this they arrived at the conclusion that light travels in straight lines from its source or from the object which it illuminates. Not only are we able to see objects because of the light reflected from them, but it is also interesting to note that no object has any inherent color of its own, but reflects a hue which is the sum of all the colors of the spectrum other than those it absorbs. The word "illuminate" means to decorate and we may truthfully say that illuminated objects are literally painted with light. As already indicated, white light is composed of all colors of the rainbow, and we see the rainbow when the white light of the sun is separated into its component parts which is accomplished through the law of refraction. So called colored objects, however, reflect their hue because of their power to absorb some of the colors of the spectrum and to reflect others.

That objects take their color from the light is readily illustrated when we place a red object under a light, such as that given by the Cooper-Hewitt mercury vapor lamp, in which there is no red ray, and under such lighting conditions the red object appears absolutely black. Material of the same color under say, gas light, the Mazda lamp, and carbon lamp, and the mercury vapor lamp would under each system appear altogether different.

One poet very aptly describes this law in a verse which reads:

"Colors are but phamtons of the day,
With that they're horn with that they fade away,
Like beauty's charms, they but amuse the sight,
Dark in themselves, till by reflection bright;
With the sun's aid, to rival him they boast,
But light withdraw, in their own shades are lost."

This suggests the necessity for careful selection of the light source if satisfactory illumination is to be secured.

Light is not necessarily split up into its component parts when it is refracted or bent. An experiment attributed to Bacon may be described in order to illustrate this, although you are all familiar with the fact that a stick thrust into the water at an angle, appears to be bent, and other illustrations of this law of refraction will also suggest themselves to you. The experiment of Bacon was to place a small coin in the bottom of a bowl and then to raise the bowl to such a level with the eye that the coin is just out of sight. By carefully pouring water into the bowl, without disturbing the coin, it nevertheless comes within the range of vision showing that the rays of light entering and leaving the water from the air, or in other words, passing from a medium of one density to that of another, are refracted or bent.

[1]Lecture before Alameda Electrical Development League, Oakland, California, August 30, 1913.

Light is said to be transmitted when it passes through an object more or less transparent. Whenever light is transmitted or reflected a loss in intensity occurs and this is referred to as absorption. Even in passing through the atmosphere the absorption of the sun's light is about 16 per cent.

Another law of light with which we are all familiar and which is too often too glibly quoted without reference to other circumstances affecting its accuracy is the so-called law of inverse squares—that light varies inversely as the square of the distance from its source. It would seem from such a statement that it is impossible to place a light unit, as a reflector and lamp is called, at different heights above the floor, or other reference plane, and still secure the same illumination, but we know that by using the proper reflector it is possible to place the unit, six feet, nine feet six inches, fifteen feet or at other proportionate mounting heights and yet still obtain the same intensity of illumination. This may be done by using various types of reflectors. I have used concentrating reflectors for auditorium lighting where the units were installed sixty feet high, and the resultant illumination was not only everything that could be desired but the installation was also economical in operation.

In speaking of the law of inverse squares we have mentioned the reference plane, or plane of illumination as it is usually designated, this being the plane upon which the illumination is figured; generally the surfaces upon which work is to be done such as tables, counters, desks, or the floor. The mounting height is the distance between the lighting unit and the floor.

Yesterday we designated the sizes of lamps by their candle power, today by the watts which they take, and tomorrow I believe that we shall ask for lamps giving so many lumens of light flux. The term "candle power," as applied to electric lamps was misleading. There are three ways of expressing the candle power of a lamp, and for their own advantage, some manufacturers were pleased to introduce a fourth. The candle power rating of incandescent electric lamps is the candle power given out by the lamp in a horizontal direction as measured when the lamp is revolving at approximately 120 revolutions per minute. The horizontal candle power is the greatest and is given off in the most useless direction. It is no indication of the total amount of light given by the lamp. In fact the distribution of light around bare light sources is almost invariably unsatisfactory, more light usually being thrown in other than useful directions. Where manufacturers, such as those of so-called gas arcs developed lighting units giving their maximum candle power perpendicularly this maximum candle power rating was given as the candle power of the lamp and candle power comparisons were drawn between that and the electric lamp on the basis of its horizontal candle power to the bewilderment of the uninitiated. The measurement of the lower hemispherical candle power was adopted by those manufacturers of lamps which threw practically no light above the horizontal and again comparisons with other lamps were made on an unfair basis. But lamps giving the same horizontal candle power or the same lower hemispherical candle power may on the other hand each give a total quantity of light which varies widely and as by the use

of properly designed equipment it is possible to utilize practically all of the light flux, as it is called, it is at once evident that the only strictly comparable method, or intelligent method of purchasing lamps even, is by stating the number of light units, or the light flux, generated by a lamp. Then without reference to efficiency, we shall be able to ask for exactly the "size" of lamp we require.

The quantity of light given off is expressed in lumens. A lumen of light flux is the quantity of flux-of-light required on a surface one foot square in order to give that surface an illumination of one foot-candle. Obviously, a foot-candle is the unit of intensity obtained at a distance of one foot from a light source of one candle power when the plane on which the illumination is considered is perpendicular to the light ray. The foot-candle is the unit of the intensity, of illumination. From our discussion so far we can readily see that a surface having an area of one square foot and receiving one lumen of light flux has an illumination of one foot-candle or one lumen per square foot. This shows that we can, if we wish, express illumination in terms of lumens per square foot instead of foot candles. The terms are in this sense, interchangeable.

If we have a given area and desire to obtain a given intensity over that area, we can easily determine the effective lumens, or quantity of light necessary to produce that intensity, by multiplying the area by the desired intensity, the product being the effective lumens. If we know the efficiency of the equipment to be used for redirecting the light into useful directions we can arrive quickly at the total light flux—lumens—or size of lamp required to secure the desired results.

This part of our subject is worth summarizing. Each lamp generates so many lumens. If the lamp is used without a reflector much of this flux-of-light is wasted on the upper part of walls and ceiling. The use of reflectors permits the redirection of much of this flux-of-light, otherwise lost, into a useful plane, but if the reflector is not scientifically designed, it becomes merely a shade absorbing the light and results in loss—inefficiency.

At this point I do not wish to be misconstrued. It is not to be supposed for one moment that I would advocate the use of reflectors for all light installations and consign the many beautiful shades to the limbs of oblivion. They have their uses, but it should be borne in mind that we pay for artistic or decorative appearance but the loss of efficiency may be entirely a mechanical loss. Here let me mention that the term efficiency is a loose term which has many applications and for this reason manufacturers' statements regarding the efficiency of the units which they manufacture are not always strictly comparable with those of other manufacturers. The visual efficiency of the resultant illumination is quite as important as the reflecting efficiency of the equipment as is the direction in which the light is projected.

We sometimes hear it stated that certain people use an oil lamp for reading because it is easier on the eyes. This is only comparatively true, for the comparison is usually made between a student's oil lamp and an inefficient electric lighting installation. Electric light may be so installed that it is incomparable, giving a sufficient quantity of illumination, economically, and eye ease or comfort in reading. Let us take second place to no competitive illuminant.

Used bare, as a light source is called which is not equipped with a shade or reflector, any light is not only undesirable but may be harmful, and the improper use of equipment is equally bad.

The co-operation of the incandescent lamp manufacturers has given us wonderfully efficient electric lamp bulbs, research and experimentation by the manufacturers of lighting equipment has produced shades and reflectors which permit the correct installation of these, but it is left to the co-operative effort of architects engineers, central stations, jobbers, fixture manufactures, and contractors, to see that these lamps and reflectors are so installed that the results will be satisfactory to all and so contribute toward the progress of the industry.

To be satisfactory a lighting installation must provide sufficient quantity of light, the necessary artistic effect or appearance, the proper quality of light, and the maximum of eye comfort, for the most important consideration in installations other than those used for scenic or spectacular effects is, that the ease with which we are able to see under an installation absolutely determines its value. Economy of maintenance and operation are important and often first cost a serious consideration, but if these prevent the installation of a system giving ocular comfort they should be eliminated as of no consequence. This often means considerable sales effort but is well worth while in the long run as it further popularizes the use of electric light and it was my experience as a central station sales manager, that the better the installation, the longer the hours it would be used and if with electric light, excellence and hours use is not the measure of increased business for all concerned, I would like to know what is.

We accept so much as a matter of course. Did we stop to consider we would realize somewhat the tremendously increased amount of work which we give our eyes to do as compared with what they had to do only twenty-five years ago. Electric light has turned night into day—has increased hours during which work is possible, lengthened the hours for study and pleasure—and we have not been slow to take advantage of this. Sometimes after an extra long session we drop back into a chair and our hands go up to our eyes as we close and rest them. Are we fair to ourselves and the community if we install lighting systems which are inefficient because of glare? What kind of illumination best contributes to eye comfort?

Quantity of illumination is important as already stated but it is true that within a very large range of intensity of illumination our vision is equally effective for all ordinary purposes. The reason for this is well-known. The iris of the eye, working rapidly and on the principle used in the diaphragm of a camera shutter, but automatically, adjusts itself to varying intensities, thus permitting greater or less amount of light to enter the eye from objects which are thus clearly seen. That we are able easily to read or work from sunrise to sunset, and then again under varying inten-

sities of artificial illumination, shows the remarkable range of the automatic adjustment of the iris of the eye. The light to which the eye is most habituated is daylight, which with its absence of pronounced color steadiness, downward direction, good diffusion, and therefore absence of pronounced shadows is the light which we must approximate if we are to secure the maximum eye comfort.

I was going to say, that one of the most glaring cases of glare is the automobile headlight which is inflicted upon all of us and which should be eliminated. I mention it here, to illustrate a point.

The adjustment of the iris of the eye is by no means instantaneous in action and the eye, after having been rested in darkness becomes very sensitive. A very low intensity of illumination is then sufficient to see by. The flinching and sometimes positive pain which we experience when the headlight flashes in our face is caused by too great an amount of light entering the eye and this light impinging on the retina leaves a pronounced image for a considerable period and causes eye fatigue. The iris adjusts itself with reference to the greatest intensity of light within the range of the eye and if an area is encountered which is of greater brilliance than the illumination intensity of the working plane the installation will be unsatisfactory, no matter to what extent the size of the lamps may be increased. We may state therefore that glaring light sources, or, glare, causes a depression of the visual function, which is characterized by the inability of the eye to distinguish fine detail and the more slight contrasts which are readily distinguished when the visual function is not depressed. The trouble occurs when depression of visual function causes eye strain which reacts upon other parts of the eye than those immediately affected.

The mere installation of an enclosing globe, giving good diffusion, about a too brilliant light source may or may not eliminate glare, depending entirely upon the background against which it is viewed. If the background be light, glare may be entirely eliminated, but if it be dark then glare will still obtain because of the contrast which exists. Similarly, contrast between brilliantly lighted ceilings and dark indirect bowls when these come within the range of vision is equally unsatisfactory and should be discouraged.

That light sources of great brilliancy or, contrasty installations, are annoying should be sufficient reason for their avoidance and that installations causing ocular discomfort may be positively injurious to eyesight should be sufficient argument to dissuade the most penurious customer from making a "cheap" inefficient lighting installation.

Correct lighting installations avoiding these objectionable features may be made simply by surrounding the lamp with a diffusing globe, or it may be surrounded by a deep reflector which does not show areas of high intrinsic brilliancy, or again, the light sources may be installed near the ceiling or at such heights that ordinarily they will not come within the range of vision. This last method, if the lamps are properly spaced and equipped with correctly designed reflectors, is the most satisfactory of all. The use of a diffusing globe is the least satisfactory.

For many conditions, semi-indirect units properly installed afford a very scientific and satisfactory solution, but a discussion along this line would at present take up too much time. Our subject must be kept within reasonable bounds and so for the present I will rest my case where it now stands. At any time in the future I shall be only too glad to elaborate upon any part of this general talk.

Correct illumination also calls for co-operation between the decorator, and the architect, and ourselves. You should welcome the architect to membership in your society, for the architect perhaps more than any other professional man, is able to bring about the realization of our ideal; raising standards of excellence both as regards materials and methods, harmonizing decorations and lighting system and emphasizing the artistic which we with our eye on the practical may be apt to forget. We need have no fear, in letting the architect take the lead in this matter for he is really one of us.

There are other conditions than those of glare which contribute to eye strain, but sufficient has been said—I believe—to arouse interest on this subject. The lighting of public buildings, window lighting, store lighting and the illumination of the home all call for the exercise of our care and consideration in eliminating this objectionable feature of glare from our lighting installations. The present widely adopted method of ornamental street lighting is a step in the right direction. The correction of lighting evils would mean tremendously increased business, and is worthy your most careful study and the application of your endeavor.

There is today nothing that can add more to the attractiveness and prosperity of your city, or contribute more to the success of its residents than such cooperative effort on your part. Take the one item of street car lighting alone where glaring light sources, which might be replaced with correct lighting installations, are the rule. The replacement of these would mean big business as also, for I can speak from experience, would be the re-designing along correct lines of the majority of store and store window lighting installations. And so we might go on.

The report of Washington's state tax commission shows that 25 of the 39 counties in the state have no electric lines. The remaining fourteen counties have a total of 922.89 miles valued at $48,428,890 with an assessed valuation of $21,505,299.

The Saskatchewan government telephone system in the Canadian Province of that name expended $1,526,755.95 during the year ending February 28, 1913. The gross income amounted to $392,393.17. During the year construction has been done as follows: New toll offices, 46; new exchanges, 34; pole miles, long distance, 516.22; wire miles, long distance, 3766.8 and service was extended to 4,288 new subscribers during the year, making a total of 9,850 subscribers now being served. The telephone situation in this great grain growing province at the present date shows 251 rural telephone companies, 22 independent companies, 5 municipal telephone systems in addition to the government system.

INTEGRITY AND "ELECTRIC" ADVERTISING.

BY R. E. HOLLIDAY.

The undisputed efficiency of the electric sign as an advertising medium has developed that industry to such an extent that it is today a real science and experts are devoting their whole time and ability to produce by plaster effect and color combinations such results as make for individuality and originality, the key note of successful advertising. This applies more especially to roof and other spectacular display signs although we find more attention has latterly been given to the smaller type of signs, those used by the retail merchant and it is in regard to this smaller class of sign that the writer has reference.

As one walks through the main streets of any large city wherein electric signs are allowed to project over the sidewalk the thought invariably comes "what a jumble." There is much light to be sure, a splendid thing for the streets and its people, and great protection, too, but where is the art? Where symmetry? Where the advertising value of each merchant's sign? All gone. Even if one or all existed. Such results are brought about by the lack of integrity in the average sign salesman. His first and last thought is, "get the order." No thought is apparently given either to original design, nor flashing effect and certainly no consideration is given to the location of the sign, when hung. Thus the chaotic day and night aspect of our streets, so also is the value of the advertising reduced to nil, hardly is it worth the merchants' while to operate this sign, let alone the fact that he gets no returns for investment herein.

If the sign salesman would cultivate just a little integrity, common, ordinary honesty, in his dealings with the buyer a great change would result. Our streets could be made truly artistic, the merchant could retain his identity, the city authorities would be glad to help in many more ways than they do now, and it would considerably lessen the tendency to legislate against this particular class of signs.

The sign manufacturers themselves should pay very much closer attention to this matter. By employing only such salesmen whose knowledge of what can and cannot be done by an electric sign will preclude the selling to merchants of something that becomes an eyesore and detriment, not only to the street's appearance, but to the selling company's repute, they will materially raise the standard of the smaller branch of electric advertising.

The time is drawing near when city authorities will sicken at the lack of effort along these lines and will drastically legislate against sidewalk electric signs and the sign manufacturers will have only their indifference to these vital issues to blame. Another most important question and one too that shows a lack of integrity both on the part of salesmen and manufacturers is the attempt to "put something over" on either the city inspectors or other authorities responsible for proper ordinances or rules for electric installations. A determination to work in accord and entirely up to those rules and codes extant will help the persons responsible for proper and safe installations and again raise the standard of our business. Let us adopt the slogan, Electrical Integrity.

WINDMILLS FOR GENERATING ELECTRICITY.

The principal component of a windmill is the wheel, the spindle of which is turned parallel to the direction of the prevailing wind (by a guide vane), in order that all blades may work uniformly. To avoid wasteful eddy currents, the blades should not be too close together, and should not extend to the centre of the wheel. The following table shows the horsepower which can theoretically be realized from a 28 foot wheel exposed to winds of various velocities:

Speed of wind, M.P.H.	H.P.	Speed of wind, M.P.H.	H.P.
2.25	0.04	22.5	40
6.7	1.1	33.5	135
11.2	5.0	45.0	520
15.7	13.0	67.0	1,080

The power available should increase with the cube of the wind velocity (since the kinetic energy of the air particles increases with the square of their velocity and the number of them striking the wheel blades per second increases in direct proportion to the wind velocity). It is not practicable to construct a mill which will utilize with equal efficiency a light breeze and a strong wind, hence the curvature and setting of the blades should be such that the mill works most efficiently when exposed to a wind of the velocity generally prevailing in the district concerned. If a wheel be designed to utilize with maximum efficiency a wind of 22.5 m.p.h., it will not run in a 7 m.p.h. breeze, since the power corresponding to this wind is less than the power required to overcome the light load losses of the wheel and its gearing. Breezes of 8 to 15 m.p.h. are much more common than 20 m.p.h. winds, hence it is generally advisable to employ, for driving lighting or other dynamos, a very light wheel which will start work in a 3.5 m.p.h. wind, and which can still be used when the wind rises to 10 m.p.h. Such a wheel could not be exposed fully to a 30 m.p.h. wind, and for safety a device should be mounted on the main wheel, so that when the wind pressure exceeds a certain limit, the inclination of the blades is changed, against the control of a spring, in such a manner as to reduce the effective area exposed to the wind. The control springs may conveniently be set so that they come into operation when the wind velocity exceeds 16 m.p.h., and so that the output of the mill is constant in winds above 18 m.p.h.; there is thus secured maximum total annual output. Dynamos employed with windmills should not be excited from the battery, since the voltage of the latter may be very low after a long period of calm weather. The automatic main dynamo switch should operate when the machine voltage just equals that of the batteries, and mercury contacts should not be used.

To detect carbon monoxide in the atmosphere the "toximeter" has been invented by a Frenchman named Guasco. When this gas is absorbed by platinum sponge the platinum becomes rapidly heated. This rise in temperature can be shown by a differential thermometer which can be graduated to show the presence of one ten-thousandth part of the gas.

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POWER AND GAS

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

The Hazard of Centralization

The development of the electrical industry has been characterized by a gradual process of centralization. Smaller plants have been combined into larger systems, and the whole interconnected by a great network, whereby both physical and financial control is brought to one center. The system acquires the compact vigor of one man, great economics are effected and increased efficiency is gained. Better results are attained by fixing definite responsibility. Within certain limits this plan promises to work admirably and may benefit the industry.

But these benefits may be offset by corresponding disadvantages which should be anticipated and guarded against. To concentrate confidence in the hands of a few men whose whims may waver with the wind does not provide a sufficient factor of safety. Where political power has been so placed in the past great abuses have crept into the body politic. History is a stern and inexorable judge whose facts seem sterile except to those who under the bare fact see the soul of the fact. If men in the past have revolted against one-man political power are they not as liable to chafe under too great centralization of utility control?

For example a water company supplying a great area would be wise in delivering water only to the limits of each town, rather than to the individual consumers. Separate ownership and management of distributing plants and systems would be of greater benefit to each community. The same is true of any other public utility. The recent strike in the silk mills of Massachusetts is said to be largely due to an absent ownership which prevents a sympathetic understanding of local needs. The peril of centralization lies not at the center but at the circumference.

Centralization is frequently advocated because it leads towards standardization. This, however, is not an unmixed blessing. When methods are so standardized that no change can be made progress is killed and the industry will stagnate. An iron-clad policy and a stereotyped plan of procedure cannot be made universally applicable nor can one central office intelligently regulate all details in outlying communities.

Comparative isolation of electric distributing systems would eliminate much damage from strikers, for each community would be far more interested in their restraint than where the responsibility rests with some central and distinct office. The great danger of a unified electric system is that the management will not keep in touch with the various individual communities. The present central station system does not give the personal and prompt attention to requests and complaints that is necessary to maintain a favorable public opinion. Each locality and each consumer in each locality has certain peculiarities which demand specialized attention. When a system covers a large area and serves many small towns it is difficult to

maintain the close relationship with municipal governing bodies and individual customers which contributes greatly to the financial success of the company.

Electric Mine Hoisting

It is only a few years since the difficulty of controlling the speed of the alternating current motor made it of secondary consideration to the direct current type for mine hoisting purposes. In these few years such great strides have been made that now almost any type of electric motor can be used for mine hoisting because the ingenuity of the designing engineer has provided some apparatus for controlling it.

In the modern mine installations along the Mother Lode of California the old form of drum controller made familiar by the electric railway is a thing of the past, largely because of the more exacting requirements of this form of transportation. The operator of an elevator or street car is always stationed on the moving car, whereas in mine hoisting he is stationed at the mouth of the shaft and sees the car only at the end of the trip. Great variation in speed is necessary, yet it must be always under absolute control. To meet these requirements two general methods have been devised, the rheostatic and the varying voltage, the one varying the current and the other the voltage of the motion. As the former is simpler, though less precise, it has been adopted in a majority of cases.

The speed is controlled by varying the resistance in the secondary circuit of the polyphase motor, reversal being accomplished by interchanging two of the primary leads. For the large motors used on the Mother Lode the circuits are broken by means of magnetic contactor panels operated from a master controller on the engineer's platform, so that only the low amperage necessary in magnetizing the contactor coils pass through the master controller.

While electric hoisting is perhaps the most important single contribution of electricity to mining, its other advantages of convenience and economy, its flexibility and efficiency, its capability of transmission and its universality of application, is fast giving it preeminence over steam, hydraulic and compressed air power for other phases of mine service. Closely allied to hoisting is under ground tramming, for which electric traction is well suited as a substitute for mule or man power.

Aside from these problems of the transportation of ore, mining engineers are much concerned in the economical handling of water to be removed from and air to be admitted to underground works. There are few mines where constant pumping is not necessary to prevent flooding and continual effort not being made to provide good ventilation. Natural means are employed so far as possible, but where gravity is unfavorable, electricity is readily available. For handling water reciprocating or centrifugal pumps are efficiently and conveniently driven by electric motors. The high head multi-stage turbine pump can now be made to lift to a head of two thousand feet. It is a moot question, however, whether it is not more advisable to have the stages in the shaft rather than in the pump. The manifold advantages of an electric driven ventilating fan are causing its introduction into mining work. Electric drive of air compressors is also proving satisfactory in supplying power for drilling, though a practical electric drill has also at last been devised.

For ages the miner has groped his uncertain way through drifts and stopes by the light of a flickering candle or an ill-smelling oil lamp. Extinguished by a breath it plunged the bearer into total darkness with great danger of a further plunge into an unguarded winze. Today there are but few stations and levels in a modern mine that are not electrically lighted. As a consequence the work is better done and the miners' health better preserved. For portable use the storage battery tungsten lamp is also becoming a valuable means of exploring dark underground recesses.

The mine telephone, giving direct and instant communication from the most remote workings to the surface, is of untold convenience, as is also flashlight signaling by interrupting the current passing through the incandescent lamps, which is replacing the time-honored bell and cord.

Passing from the underground workings to the surface we find electric timber-framers and machine tools doing better work in less time than can be accomplished by hand labor. The blacksmith may use an electric drill sharpener and harden his drills to an exact nicety in an electric tempering furnace. In the mill individual motor drive of crushers, stamps and concentrators does away with unsightly and cumbersome shafting and belting, together with its attendant inefficiency. The magnetic and electrostatic properties of certain minerals makes possible their separation from the gangue and thus concentrates them for other treatment.

In metallurgical work electricity is daily increasing in value. The latest practice in the chlorination process is to produce the chlorine by electrolysis. This method has been adopted and is in everyday use in the United States Mint, as is also the electrolytic deposition of gold and silver from their solutions. In the cyanide process, bright minds are now at work on this same problem.

The greatest opportunity for metallurgical work is the adaptation of the tremendous heat of the electric current to the smelting of ores. This is already in successful use in treating iron and zinc and, with increasing cost of fuel and decreasing cost of electric current, will soon be applied to the other metals. So rapidly are the manifold advantages of electricity being applied to every department of mining work that a knowledge of the principles of electricity will be as indispensable to a mining engineer as is an understanding of chemistry and geology.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Thos. Finnigan, vice-president of Pierson, Roeding & Co., is at Los Angeles.

O. B. Penrose of the Fobes Supply Company, Seattle, was in San Francisco during the past week.

H. N. Lauritzen, Pacific Coast manager for the Holophane Works of the General Electric Company, is at Los Angeles.

C. E. Dunbar of the Western States Gas & Electric Company, Stockton, is spending the week in San Francisco on his vacation.

R. Worth, northwest branch manager American Ever Ready Company, spent a few days in Vancouver, B. C., last week on company business..

R. E. Briggs, of Gill & Company, manufacturers of illuminating glassware at Steubenville, Ohio, is expected at San Francisco this week.

H. M. Ferguson has succeeded **J. F. Derge** as manager of the commercial department of the Missoula Light & Water Company at Missoula, Mont.

H. L. Eicher, acting manager Fort Wayne Electric Works of the General Electric Company, Seattle, is spending his vacation in northern Washington.

Geo. C. Holberton, manager Pacific Gas & Electric Company, San Francisco, left the latter part of last week for an extended trip through the East.

M. L. Scobey, salesman with the Pacific States Electric Company, San Francisco, has returned after a three weeks' trip through Southern California.

J. H. Hornung, formerly associated with the Great Western Power Company, has become manager of the San Francisco, Napa & Calistoga Railway.

A. L. Thorn, deputy manager Tacoma light department recently returned from a two weeks' business and pleasure trip to the Coos Bay country in Oregon.

E. M. Cutting, manager Edison Storage Battery Supply Company, returned the first part of the week from an extended trip through Oregon and Washington.

M. F. Steele of the Benjamin Electric Company, San Francisco, returned the latter part of the week from a several days' trip to Los Angeles and Southern California.

W. W. Briggs, manager Great Western Power Company, San Francisco, left the latter part of the week on a business trip to Sacramento and the Sacramento Valley, California.

B. W. Mendenhall, commercial agent for the Utah Light & Railway Company, of Salt Lake City, is attending the Seattle convention of the N. W. Electric Light & Power Association.

H. J. Mitchell, formerly associated with E. P. Jamison & Company, Seattle, has resigned from that concern to accept the agency of the Edison Storage Battery Supply Company at that city.

C. E. White, manager of the Montgomery (Ala.) Light & Water Power Company, has been appointed the delegate of the Southern Gas Association, of which he is past president, to represent it at the International Gas Congress at San Francisco in 1915.

G. J. Desharats, deputy minister of marine, has completed an inspection trip of all wireless stations on the western coast of Canada. The revenue from the wireless stations has been on the steady increase since their inauguration by the Canadian government.

W. H. P. Hill, formerly manager of the Santa Rosa District of the Great Western Power Company, has been placed in charge of the Sacramento district with headquarters at Sacramento. **B. M. Levy** of the same company has been appointed manager of the Santa Rosa district.

George R. Murphy, manager of the storage battery department of Pierson, Roeding & Company, is at Seattle, where he will attend the convention of the Northwest Electric Light & Power Association. He will also be present at the Pacific Coast convention of the American Institute of Electrical Engineers at Vancouver next week.

A. L. Havens, for the past five years manager of the Los Angeles office of Pierson, Roeding & Co., has resigned, and **R. H. Husbands** has been appointed his successor. Mr. Havens' private interests have assumed such large proportions in the Southwest that he finds it necessary to devote his entire time to those interests. The business of Pierson, Roeding & Co. in the Southwest has flourished under Mr. Havens' able management, and his many friends regret that he is to no longer be actively associated in the electrical field. Mr. Husbands, who assumes the position as manager, was for six years manager of Pierson, Roeding & Co.'s Seattle office. He is thoroughly conversant with the company's business, and will, no doubt, continue the successful work inaugurated by Mr. Havens.

ELECTRICAL JOBBERS' MEETING.

The Pacific Coast electrical jobbers will meet at Gearhart, near Portland, Ore., on September 18-20. A special car will leave San Francisco on train No. 16, at 8:20 p. m., September 16. F. N. Averill, Fobes Supply Company, Portland, is chairman of the local committee of arrangements.

SAN FRANCISCO ELECTRICAL DEVELOPMENT AND JOVIAN LEAGUE.

Last Tuesday's meeting was the opening meeting of the new term, the League having taken a two months' vacation during the summer. Mr. W. F. Neiman, vice-president, presided, President W. S. Berry being absent on a business trip in the East. After an opening address of welcome by Mr. H. V. Carter, the speaker of the day, Robert Newton Lynch, vice-president and manager of the San Francisco Chamber of Commerce, was introduced. Mr. Lynch took for his subject co-operation among various public bodies and concentration by each upon some particular and definite line of operation and sticking to the same until the object has been accomplished. The address was most interesting and instructive, Mr. Lynch detailing some of the work before the Chamber of Commerce and how it was hoped to be accomplished through the plan of concentration. A hearty vote of thanks was given the speaker by the fifty or more members present.

OREGON SOCIETY OF ENGINEERS.

The report of the Committee on Engineering Education, D. C. Henry, chairman, of the Oregon Society of Engineers, on the proposed action of the Board of Higher Curricula, State of Oregon, seeking the elimination of duplicate courses of study in the Oregon State University and the State Agricultural College, and confining the engineering course to the State University entirely, was presented before the latter body, August 5th.

The conclusions upon which the report is based were arrived at after answers were received to a series of questions on the subject submitted to eminent engineering authorities in various branches of the service in different parts of the United States as follows:

1. We believe that the engineering courses should be left in the university as they are at present, until, more complete study of the problem can be made, or until the question of a combination of the two schools is settled.

2. If a change is made, practically all engineering should be placed in the university.

3. The entrance requirements should be high.

4. Oregon should plan for a future when the state will have a large population and great wealth. At present her population is small and she cannot expect to support such schools as some of her neighbors maintain.

There is considerable probability that a student who does attend school in another state will secure employment there after graduation, and in a sense be lost to his own state.

5. In conclusion we desire to have it understood that our motive is to aid in the right solution of this significant problem. We consider the work of the university and the agricultural college of equal importance to the state, and will give our hearty support to both, either as separate schools or in combination.

The Oregon Society of Engineers has been asked through its committee, to prepare suggestions for a suitable curriculum leading to the degree of engineer, which will probably come up at the December 2d meeting of the Board of Higher Curricula.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission issued a supplemental order authorizing the San Diego Consolidated Gas & Electric Company, to issue $33,000 of its 5 per cent bonds at not less than 85.

A decision was rendered authorizing the Midway Gas Company to issue $75,000 of promissory notes for the purpose of refunding notes held by the Bank of California.

A decision was rendered permitting the Southern California Edison Company to pledge its 5 per cent bonds of the value of $400,000 for the purpose of making extensions to its system.

TRADE NOTES.

The Tacoma Electrical Machinery Company, Tacoma, is installing a 20 h.p. Allis-Chalmers motor at the plant of the Tacoma Boiler Works.

The Fort Wayne Electric Works of the General Electric Company, Seattle office, has sold to the city of Sumas, Washington, $500 worth of meters.

The Allis-Chalmers Manufacturing Company, San Francisco, has sold to the Fresno Traction Company, two 600 kw. motor generator sets.

The St. Paul & Tacoma Lumber Company, Tacoma, has put into operation its recently installed 1000 kw. turbo generator plant. This is to be used in operating its planing mill.

The Pacific Electric Manufacturing Company, San Francisco, has shipped to the Pacific Light & Power Corporation, Los Angeles, six 60,000 volt pole top switches of the Baum type.

The American Engine & Electric Company, Bound Brook, N. J., has taken over the business of the American Engine Company and will manufacture high speed steam engines and a complete line of motors and generators.

A shipment of hydraulic machinery from the Joshua Hendy Iron Works, San Francisco, to the Alaska-Gastineau Mining Company, Juneau, Alaska, was lost in transit in a storm on the coast and the entire equipment is being duplicated.

On the application of the Chicago Title & Trust Company and W. E. Rieley the superior court of Ferry county, Washington, appointed Warren W. Tollman, an attorney of Spokane, receiver for the North Washington Power & Reduction Company.

Charles C. Moore & Company, San Francisco, have closed a contract with the U. S. Reclamation Service for five 50-inch Plat Iron Works centrifugal pumps. One 50, two 36 and three 26-inch pumps of this type have been contracted for by the Solano Irrigated Farms.

The Edison Storage Battery Supply Company is installing a complete emergency lighting plant on the private yacht of D. C. Jackling under construction at Seattle, Wash. When completed the plant will consist of 100 cells of A-6 Edison batteries and have a 225 ampere hour capacity.

The Inland Empire Paper Company, Spokane, will install three 1000 kw. oil insulated water cooled Allis-Chalmers transformers. These will be used to reduce the 60,000 volts line current of the Spokane Inland Railway Company's current to 440 volts service for driving various motors.

The Puget Sound Traction, Light & Power Company have recently purchased a 1000 lb. and a 3½ ton truck, both equipped with Edison storage batteries for use in their service work at Seattle and another truck equipped with Edison batteries is on the way from the East to their station at Tacoma.

The Edison Storage Battery Supply Company is to have a complete house lighting plant on exhibition at the coming State Fair to be held at Sacramento, September 13th to 20th, inclusive, and will light their booth from their own plant, as well as make several other demonstrations with Edison storage batteries.

The Reynolds Electric Company, Seattle, has sold a 50 h.p. two-phase, 2300-volt motor to the Barber Asphalt Company, a 20 h.p. two-phase induction motor to the Eagle Laundry Company, and is installing same. The company is also repairing the 650 h.p. motor of Lewis, Wiley & Morse, Inc., hydraulic engineers and contractors.

Albert Kelley, a steel contractor of Seattle has closed a contract with the Pelton Water-wheel Company of New York and San Francisco, to install for the Vancouver Island Power Company, two miles of welded steel pressure pipe, ranging from 48 in. to 54 in. in diameter. The pipe is for the hydroelectric plant of the company, and it is to be laid along the Jordan River some forty-six miles from Victoria. The work is to start on September 1st and to be completed in ninety days. This line is planned to add 25,000 horsepower to the present capacity of the plant.

ENGINEERING LIBRARY FOR TECHNICAL SOCIETY OF PACIFIC COAST.

The Technical Society of the Pacific Coast has been requested by the librarian of the Mechanics Institute to help him in the preparation of a list of books, periodicals, magazines and publications, to be referred to and to be consulted in the formation of a good engineering reference library, which has been a want long felt by the engineering professions in and about San Francisco.

To that end the president of the Technical Society of the Pacific Coast has appointed a committee to formulate a plan, by which the ideas of members of different technical organizations having local branches could be obtained, compiled and submitted for the purpose above indicated.

The committee thinks that the best way of arriving at the desired result is to instruct the secretaries of the local societies to include in their usual notices to members a circular letter, setting forth the above information, and asking each member to submit, at the earliest possible date, a list of such publications as he may deem desirable from his own standpoint, and from the standpoint of those whom he knows to be interested in the particular subject that he may represent or have in mind.

It is contemplated to obtain or compile a complete index system, by means of which all the articles relating to a particular branch or subject may be easily found with the expenditure of a minimum of time and effort.

As a library of the character contemplated will be of great value to the engineering professions, the co-operation of all engineers interested is urgently desired and requested, in order to make the list as complete and universal as possible.

Suggested lists, properly classified as to the engineering branches involved, should be addressed to the Engineering Reference Library Committee, care Otto von Geldern, secretary, 865 Pacific building, San Francisco.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

REQUIREMENTS FOR ELECTRIC SERVICE AT PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

(Concluded)

Service cabinets or fuse boxes for consumers purchasing energy on a flat-rate basis need be only of sufficient size to accommodate the service fuses. Said cabinets or boxes to be provided with fastenings to permit sealing the box.

The sealed service fuses wheu blown will be replaced by the exposition at the expense of the consumer.

All d.c. motors and all a.c. motors of 5 h.p. and over shall have their starting devices fitted with a no-voltage release.

Consumers having a 120-volt connected load to any one service of over 2 kw. shall have their installation wired for a three-wire service.

Participants shall install, where directed, such electric and gas lights for exit and patrol purposes as the director of works may require for public safety.

The decorative lighting installed by participants shall be subject to the approval of the director of works and no installation will be permitted which is out of harmony with the general lighting scheme or in any way causes inconvenience or disadvantage to other participants.

Light sources of great intrinsic brilliancy shall be fitted with suitable globes or reflectors or so placed as not to cause a disagreeable effect upon the eyes.

In case of failure of a meter to register properly or in case the meter seal has been broken, the consumer shall be liable for an average bill. Meters will te tested at regular intervals and the consumer may have access to the records of such tests. Any consumer may demand a test of his meter by depositing $3.00 with the exposition, and if the meter is found on test to be accurate within 2 per cent, said deposit will be forfeited, but if the meter is in error more than 2 per cent said deposit will be returned to the consumer. If the test shows that the meter is more than 2 per cent fast, the consumer will be refunded an amount sufficient to cover the error in excess of 2 per cent for the two months preceding the test, but if the test shows the meter to be more than 2 per cent slow, the consumer shall pay to the exposition an amount sufficient to cover the error in excess of 2 per cent for the two months preceding the test.

Electric service will be furnished at flat rates, meter rates and special rates, as follows:

Electrical installation having a connected load to any given kind of service of less than 2 kilowatts will be charged for service at a flat rate of $15.00 per calendar month per kilowatt of connected load, payable in advance. If the connected load is 166 watts or less the rate will $2.50 per month, payable in advance. The foregoing rate is based on the entire connected load being used not more than 56 hours per week, and if upon test the current consumption is found to be greater, the rate will be increased proportionately, or, if the director of works so decides, the flat rate will be discontinued and the consumer served through a meter at meter rates.

The connected load is to be determined by adding together the capacities of the lamps, apparatus and appliances connected to any one given kind of service, and the capacity of any lamp, piece of apparatus or appliance will be taken as that of the manufacturer's rating marked thereon; or by test made by the director of works. In estimating the connected load one h.p. will be considered equivalent to 750 watts.

Electric service to consumers having a connected load of 2 kw. and over for any given kind of service, will be measured by meters which will be installed and maintained by the exposition.

The rates for electric service measured by meters will be based upon the size of the consumer's connected load and the amount of energy used per month. The connected load will be determined by adding together the capacities of all lamps, apparatus and appliances served through any one meter. The capacity of lamps, apparatus and appliances will be taken from the manufacturer's rating marked thereon or the director of works may test any lamp, piece of apparatus or appliance to determine its capacity. In estimating the connected load, one h.p. will be taken as equivalent to 750 watts.

The connected load and rate charged shall be figured separately for each kind of service furnished, and in no case shall the consumer's rate be determined by any combination of the connected loads or current consumption of different kinds of service.

For electric service on a meter basis, the consumer shall pay a charge of $2.50 per month per kw. of connected load, and in addition thereto shall pay for the energy consumed at the following rates:

Five cents per kw.-hr. if the monthly consumption is less than 1000 kw.-hr.

If the consumption per month is 1000 kw.-hr. or more, but not in excess of 20,000 kw.-hr., the rate of 5c will be reduced 1/10c for each 1000 kw.-hr. consumed.

For a monthly consumption exceeding 20,000 kw.-hr. the rate will be 3c per kw.-hr.

A month will be considered as the interval between meter readings, which will be taken as nearly as it is convenient on the same date of each calendar month.

Exhibitors so located that they will not require electric service except during the daylight hours that the exposition buildings are open to the general public will be given service rates at 25 per cent less than the foregoing flat and meter rates. Exhibitors requiring electric service to operate moving machinery will be charged only for the energy, at the rate of 3 cents per kilowatt.

NEW CATALOGUES.

The Cutler-Hammer Manufacturing Company, Milwaukee, has printed a new edition of Bulletin 8540, dated August, 1913, which supersedes the former bulletin of the same number dated January, 1912. This new 24-page bulletin contains prices and data on the various types of battery charging rheostats for both lead and Edison cell batteries, including wall, floor and switchboard types.

BOOK REVIEW.

Factory Lighting. By Clarence E. Clewell; 161 pages; 6x9; 100 illustrations; cloth. Published by McCraw, Hill Book Co., New York City, and for sale by Technical Book Shop, San Francisco. Price $2.00.

Industrial Electric Lighting would be a more appropriate name to designate the scope of this work which covers many lighting requirements besides tnose of the factory, but which is limited to electric illumination. While general principles are well defined in the opening chapters, the chief emphasis is placed upon the specific requirements of a particular type to be adopted as a model for similar installations. Chapters are devoted to the proper design, to practical wiring and to methods of caring for an installation. The proper lighting of an office, a drafting room, factory, power house, steel mill and machine tools is thoroughly discussed. The underlying thought throughout is the selection of a lighting system which will increase the efficiency of workmen and as such it forms a valuable addition to the wealth of literature on this subject.

NEWS NOTES

INCORPORATIONS.

OCEANSIDE, CAL.—Articles of incorporation of Pamoosa Falls Land & Water Company have been filed with a capital stock of $100,000. The directors are C. B. Kinkead of Pala Alto, N. D. Kinkead of Escondido, and Wm. Kinkead of Moosa. The incorporators, who own property in Moosa conyon propose to develop water for application on their lands along Moosa creek.

LOS ANGELES, CAL.—Definite announcement has been made by T. E. Gibbon of a project for which funds are in sight, to build a railroad from Los Angeles to a point in lower San Joaquin Valley. It will parallel in a general way the route of the state highway through Tejon pass, and will serve as direct connecting links between the oil fields and Los Angeles. Articles of incorporation of the San Joaquin Valley & Los Angeles Railway Company, which is to build the road, have been filed, with a capitalization of $3,000,000. The incorporators are T. E. Gibbon, W. C. Shuleton, J. E. Stephens, J. E. Shuleton and J. R. Colburn.

ILLUMINATION.

KLAMATH FALLS, ORE.—A movement is on foot here for city ownership of the light, power and water systems.

COMPTON, CAL.—Sealed bids will be received up to October 7th, for a franchise granting the right to construct and operate an electric pole and wire system in this city.

SAN FRANCISCO, CAL.—The Universal Electric & Gas Company, is seeking permission from the supervisors to extend its pipe and conduit system to all parts of the city.

TACOMA, WASH.—Superintendent B. W. Collins, light and power department, will soon have data ready in reference to the establishment of a lighting system on A street, Pacific avenue, Commerce and C streets.

LOS ANGELES, CAL.—Sealed bids will be received up to September 8th by the board of supervisors of Los Angeles county, for installing and maintaining a system of street lighting in Westgate lighting district.

LOS ANGELES, CAL.—Sealed bids will be received up to September 8th, by the board of supervisors of Los Angeles county, for installing and maintaining an addition to the system of street lighting in Bairdstown lighting district.

GLENDALE, CAL.—The contract for the installation of a street lighting system in Casa Verdugo has been awarded to the electric light department of the city of Glendale, by the county board of supervisors. The contract price for the installation of the system is $10,000.

PORTLAND, ORE.—Disputed light and power rates in 17 cities of Oregon, including Portland, Oregon City, Salem, Mt. Angel and Woodburn, will come before the Oregon Railroad Commission for adjustment at a hearing in Portland on September 2d. This hearing will also have an important bearing on the proposed six-tickets-for-a-quarter street car fare ordinance in Portland. Though this issue will not come before the commission officially at that time, every element of the controversy between the city and the Portland Railway, Light & Power Company as to the fairness of such a rate, except an actual ruling on it, will be involved. The way will be opened either for the city commission or any three citizens, by making a formal complaint against present fares, to bring the question before the state commission for a ruling later. By direction of the commission, the Portland Railway, Light & Power Company is to have ready by September 1 a complete appraisement of all its properties,

TRANSMISSION.

VALE, ORE.—The Beaver River Power Company state that arrangements have been made for immediate construction of high tension line to Vale.

BOISE, IDAHO.—The Ashton & St. Anthony Power Company, capitalized for $250,000, petitioned the utilities commission for a certificate of convenience and necessity to dam north fork of Snake River, two miles west of Ashton.

TACOMA, WASH.—The Tacoma Railway & Power Company has obtained options upon property at Twelfth and Sprague streets, where the management intends to erect a new power house, storage sheds and headquarters offices.

PRESCOTT, ARIZ.—With a view to utilizing the power of Cataract Canyon, the Cataract Canyon Power Company has given an option to J. Barton Nealey, who is associated with capitalists of Bangor, Maine, who will have surveys made and will obtain other accurate data with a view to forwarding the project.

VICTORIA, B. C.—Notice has been given that the British-Pacific Hydroelectric & Tramway Ltd. of Victoria, B. C., will apply for a license to store or pen back 100,000 acre-feet of water from Nimpkish River, by means of a dam to be built about one mile from sea and will be used for industrial purposes. Objections may be filed with the said water recorder or with the comptroller of water rights, Victoria, B. C.

LOS ANGELES, CAL.—The city council has instructed the city attorney to prepare the usual preliminary resolution and ordinance, calling a special election for the submission of the question of voting $6,500,000 bonds to be devoted as follows: For the completion of the power plant, $1,250,000, and for providing the distribution system, $5,250,000. It is probable that the election will be held October 15th.

SAN FRANCISCO, CAL.—A suit in equity to gain possession of a strip of land in the Tahoe National Forest Reserve on which to construct the Drum power plant and conduits has been filed by the Pacific Gas & Electric Company against David F. Houston, secretary of agriculture; Henry S. Graves, head of the forest service of the Department of Agriculture, and others, in the U. S. District Court. The power company maintains that the act under which the land was set aside for forestry purposes is unconstitutional.

VANCOUVER, B. C.—From present indications the near future shall see the development of an immense store of electrical energy in British Columbia. The latest project has been announced by the Bridge River Company, a company recently organized by Vancouver capitalists. They propose developing upwards of 200,000 horsepower in the Lillooet district. They anticipate furnishing power to the Pacific Great Eastern Railway as it will in all probability electrify its western lines and also look forward to supplying power to the needs of Greater Vancouver during no distant date.

LAKEPORT, CAL.—The supervisors of Lake county have postponed to their regular meeting in September action on a resolution to enjoin the Yolo Water & Power Company from building a dam at the outlet of Clear Lake. Land owners at the head of the lake urged action at the special meeting of the board, and a number of representatives attended and addressed the supervisors. The contention is that the beginning of construction of the company's dam constitutes a menace to their lands and to county property in the shape of about three miles of lake front boulevard which would be overflowed by a ten-foot raise of the lake. Following the representations of the Upper Lake citizens, a number of Lower Lake residents protested against the supervisors involving the county in an injunction suit. Attorney Huston

for the Yolo company offered to raise the road affected to a height above possible damage by the rise of water. The company officials claim no intention of raising the lake until they have acquired rights to all lake frontage. They state they can conserve about 15,000 acre feet of water on their own land in Cache Creek Canyon without affecting the lake. The dam is located at the old Fowler mill site, six miles below the outlet of Cache Creek from the lake frontage. The structure is designed to be 32 ft. high and to back the water up the canyon and raise it to the desired ten feet in the lake when completed and gates closed.

TRANSPORTATION.

SANDY, ORE.—Fifteen business men of this place held a conference with President Griffith of the Portland Railway, Light & Power Company for the purpose of trying to induce this company to build an electric line into Sandy. The proposed line would be about seven miles long and would connect with the Estacada line at Boring or the Mount Hood Railway at Cottrell.

SAN FRANCISCO, CAL.—The announcement of the personnel of the new directorate of the United Railroads confirmed the impression current on the street that the officers of the public utility were to be put into the hands of a board composed of representative San Francisco business men whose policy is to be one of conciliation toward and cooperation with the city authorities, in working out San Francisco's transportation problems. The new directors are: Jesse W. Lilienthal, president; Charles N. Black, vice-president; George B. Willcutt, secretary; John A. Buck, Washington Dodge, A. W. Foster, Benj. S. Guinness, J. C. McKinstry, Henry T. Scott and L. S. Sherman. With the exception of Benj. S. Guinness, who represents the New York banking firm of Ladenburg, Thalmann & Company, the new board is composed entirely of San Franciscans. A. M. Dahler continues as treasurer of the company.

SAN FRANCISCO, CAL.—Assistant City Engineer Ransom says that all plans for the new city railways for which bonds were voted last week will be completed so that contracts may be let for car barns, track specials and all material by January 1st. Material will begin to arrive before June 1st, permitting the completion of tracks and installation of overhead electrical equipment in time for the arrival of the cars from the factory in the fall. City Engineer O'Shaughnessy reiterates his statement that all the roads will be in operation for the opening of the exposition. The Van Ness avenue and Potrero lines will be the first constructed, and the rails of the Stockton street line laid as the tunnel work progresses. Negotiations for the transfer of the Union street line to the city when the franchise expires in December will be opened at once by the city attorney and supervisors. The latter will take action to provide for the acquisition of the necessary rights of way for the car barns, terminal sites and widening of Division street.

SAN FRANCISCO, CAL.—Work on the appraisement of the Presidio & Ferries Railroad Company's holdings has been started by City Engineer O'Shaughnessy and his assistants, and rapid progress is promised. The franchise of the company's Union street line expires December next, and it is probable that this will be the first of the proposed municipal car lines to be completed. City Engineer O'Shaughnessy says: "There is no reason why the city and the Union street car line officials should not reach an early settlement in the matter of the appraisement of the ompany's holdings. The first thing the city has to decide is how much of the property and holdings of the company it wants to acquire. From my personal inspection of the line I am of the opinion that the city will be able to use at least 75 per cent of the company's track, as about that portion of it consists of heavy rails of the standard to be used on the municipal lines. This, naturally, will facilitate the city's operation of the line. There are other details for the city to work out in the matter of determining, the amount, if any, of the rolling stock of the company, its barns and other equipment. that is needed by the city. I am sure that this can all be adjusted quickly and to the satisfaction of all parties concerned."

OAKLAND, CAL.—All the east-bay cities and towns served by the San Francisco-Oakland Terminal Railway Company, except Berkeley, have agreed, through their mayors and councilmen, in conference at the Oakland City Hall, to withhold for one year further demands for street improvements and railway extensions. The concession was made as a means of assisting in the rehabilitation of the finances of the public utility company. Mayor Heywood of Berkeley and his associates in the city council favored the formation of a municipal traction district to take over the roads. John S. Drum of the F. M. Smith advisory committee, explained that an extension of time on the $2,500,000 loan from Halsey & Company has been promised providing running expenses of the road can be taken care of. Estimates submitted by W. R. Alberger, general manager, show that $50,000 per month will be required more than the income of the roads to meet payments on extensions and improvements which have already been begun. This money is to be loaned by local banks. Gavin McNab and Drum both declared that the company is in healthy condition so far as physical properties and earnings are concerned. The cities on the east side of the bay have received more from the Smith traction properties as a privately owned corporation than if the communities had themselves owned the system, McNab declared, for they have gotten back all its profits and about $4,000,000 more in extensions.

TELEPHONE AND TELEGRAPH.

MOSCOW, IDAHO.—T. A. Meeker, manager Moscow Telephone & Telegraph Company, states that two toll lines will be built out of Moscow at a cost of $10,000.

CHEHALIS, WASH.—A franchise has been granted to the Rainy Valley Telephone Company for a line from Filton Ferry to Randle by way of Cowlitz River road, and to Hannaford Skookum Telephone Company for a line northwest of Centralia in Manna Hannaford valley.

LOS ANGELES, CAL.—A six-story fireproof building is to be erected by the Pacific Tel. and Tel. Co., on the site of its present building at 622 South Hill street. Plans are now being drawn, and construction work will begin in the near future. The building will be designed for twelve stories, although only six will be built at the present time.

EUGENE, ORE.—Arrangements will be made for extension of the McKenzie government telephone from summit of Sisters in Eastern Oregon, where conections may be made with portions of the Cascade, Santiam, Deschutes and Umpqua forests. C. R. Seltz, supervisor, Cascade National Forest; Chas. H. Flory, chief forester for Oregon and Washington.

SAN FRANCISCO, CAL.—The public utilities committee of the supervisors has recommended the adoption of Vogelsang's resolution asking the city attorney to ascertain on what terms the Pacific Telephone & Telegraph Company will compromise the existing litigation over the merger of teh two companies, the Pacific and the Home. Under the Pacific company's suggested terms the city would receive a percentage of $5000 a month, or $60,000 a year, which would mean something between $2,500,000 and $3,000,000 for the city during the term of the Home company's franchise, the conditions of which the Pacific company offers to assume for the entire business of both systems. Under its original franchise the Pacific Company pays no percentage to the city, but the Home franchise calls for 2 per cent of the gross receipts.

PUBLIC LIBRARY

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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NORTH-WEST ELECTRIC LIGHT AND POWER CONVENTION.

THE REGULATION OF PUBLIC SERVICE UTILITIES.

BY GEO. A. LEE.

USE OF PROTECTIVE RELAYS ON TRANSMISSION SYSTEMS.

BY S. C. LINDSAY.

RECENT AND PROPOSED LEGISLATION AFFECTING PUBLIC UTILITIES.

BY NORWOOD W. BROCKETT.

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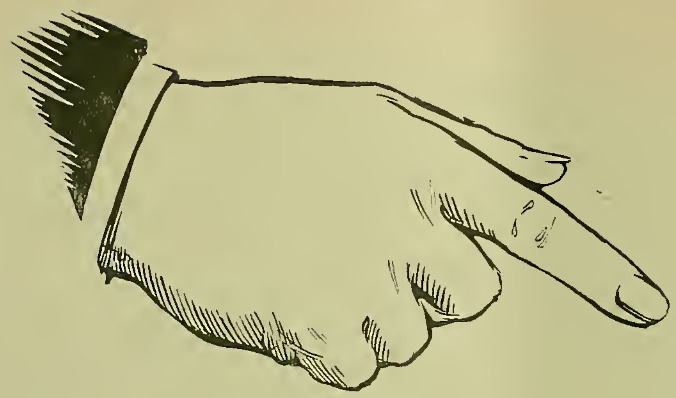

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N. W. ELECTRIC LIGHT & POWER CONVENTION

The sixth annual convention of the Northwest Electric Light & Power Association was held at Seattle, Washington, September 3d, 4th and 5th. From the standpoint of attendance, interest in papers and value of discussion it was one of the most successful yet held and speaks well for the policy of continuing independent meetings in addition to the regular meetings of the National Electric Light Association with which it is affiliated. The registered attendance was nearly two hundred.

H. L. Bleecker, the newly-elected president of the Northwest Electric Light and Power Association, is so well known to the electrical people, particularly those of the Northwest, that little need be said as to his ability to successfully fill the office to which he has just been elected. Mr. Bleecker came from Belleville, Ontario, and first started into the electrical world at the age of nineteen with the Los Angeles Cable Railway, where he remained until 1900. He went from there to the Washintgon Water Power Company at Spokane, where his ability carried him from the position of clerk to that of second vice-president, which position he now holds. His untiring efforts in connection with the work of the association and that of his company have won him many friends, who were unanimous in choosing him for the association president. To W. J. Grambs, the retiring president, too much praise cannot be given. Mr. Grambs, who is the superintendent of power for the Puget Sound Traction, Light and Power Company at Seattle, was a pioneer in the western electrical field and has been with his company since its inception. With the assistance of the other association officers, he has, during the past year, made the work of the association more keenly felt than ever before. The association as a whole has been a major factor in the rapid development witnessed in the Northwest during the last five years and is sure to develop a market for the wonderful natural resources of this section of the country.

Delegates to the N. W. Electric Light and Power Convention. Seattle, Wash.

The convention was called to order at 10 a. m. Wednesday, September 3d, a cordial address of welcome to the delegates being given by J. E. Chilberg, who certainly belies his name. The response was given by W. J. Grambs, in the course of his presidential address to the association. Various announcements and reports occupied the remainder of this initial session. The other sessions were filled with reading and discussing a number of excellent papers as detailed later.

The following officers and executive committee were elected for the ensuing year:

H. L. Bleecker .... President
Franklin T. Griffiths .... Vice-President for Oregon
E. G. Robinson .... Vice-President for Washington
John McKissick .... Vice-President for Idaho
M. C. Osborne .... Member of Exec. Com. for 3-year-term
J. E. Davidson .... Member of Exec. Com. for 2-year-term
Philip A. Bertrand .... Member of Exec. Com. for 1-year-term

Entertainment Features.

While strict attention was given to the business sessions, the pleasure part of the convention was not overlooked. On Thursday afternoon the ladies were taken on an automobile ride over the city, and on the next afternoon both gentlemen and ladies in twenty automobiles visited all points of interest in a three hours ride. While the ladies were enjoying a theatre performance Friday evening the regular banquet of the association was held at the New Washington Hotel. Mr. Arthur Gunn, first president of the association, favored the assembled members with an excellent resume of the work accomplished by the association. Mr. Grambs, the retiring president, in a strong farewell address, thanked the officers and members for the loyalty shown during his administration.

By far the most enjoyable feature of the convention, however, was the boat excursion given on Saturday by the Puget Sound Traction, Light & Power Company. The United States Navy Yard at Bremerton, which was thrown open to the visitors, offered both instructive and entertaining features to the large crowd of delegates and their families. Returning from the navy yard the crowd stopped at Pleasant Beach where refreshments and various forms of amusement were provided. The crowd that returned to Seattle Saturday evening was unanimous in pronouncing the convention a big success.

The entertainment committee is to be congratulated on their great success in showing the delegates the pleasant side of one of the greatest conventions the northwest has seen.

Technical Sessions.

Wednesday afternoon was devoted to reading and discussing several operating and commercial papers.

E. G. Robinson, manager of the Jim Creek Water, Light & Power Company, at Arlington, Washington, read a paper on **"Management and Operation of an Electric Light Plant in a Small Town,"** which described in great detail the organization and operation of a small central station company in a town of 2100 inhabitants. The plant consists of a 200 kw. hydroelectric power station with a steam relay. The company conducts a general light and power business, the power being supplied over separate circuits permitting the lighting transformers to be cut out during the day time. All of the company's activities are described, beginning with the manager, and covering the duties, compensation, etc., of the bookkeeper, linemen, stationmen, and other employes; the company's accounting methods, methods of billing, business methods and policy; also the steps taken to procure new business and build up the station load are fully described.

John B. Fisken, superintendent of light and power for the Washington Water Power Company of Spokane, Wash., discussed **"Some Operating Problems,"** only the broader problems of the operating official being touched upon. The writer first discussed the relation of the operating department to other departments of the same company and then outlines in detail a practical organization for the operating department of a company similar to the larger companies in this association. The organization outlined is such that it can be readily modified and condensed to meet the needs of smaller companies. It is of prime importance that the duties and the jurisdiction of each man in the organization be clearly defined, and to this end one of the prime requisites is red tape. "The red tape, however, should be in short length; of a considerable number and each individual red tape should be easily unwound."

Safety, and the measures to be taken to secure the protection of employes, the public, and property, are claiming the close attention of progressive companies and the writer described in some detail the safety committee plan as used by the Washington Water Power Company and other companies throughout the country. The results of this plan wherever used have been extremely gratifying and the member companies of this association will find that the plan can be adapted to the needs of the smallest as well as the largest organization.

There is probably no one subject which is claiming the attention of central station executives today as much as welfare work. The importance of caring for employes, not only in the present, but in looking out for their future, is coming to be clearly understood and the writer devoted much space to descriptions of the various means used to this end. The pension systems of Great Britain, France, Germany and Denmark were described and references made to the pension schemes of some of the large utility companies of this country. Among other things he touched upon were accidents and sickness disability benefits, employes' savings and investment funds, company stores where employes may buy the necessaries of life at cost, the menace of the loan shark, and the plan of establishing a company fund from which employes may borrow small amounts.

James E. Davidson, vice-president and general manager of the Pacific Power & Light Company of Portland, Oregon, read a paper on **"The Tireless Farmer,"** which dealt with the more important uses of electricity in rural districts in the order that they should be taken up by a central station manager from the time first thought is given to the subject. After speaking of the choice of a market, determination of the amount of business available, the education of the farmer in the use of electricity, etc., he described a large number of the uses to which electricity is being put on the "electrified farm" of today.

The writer also discussed various forms of rates for rural service, laying emphasis on the necessity for making rates as simple and easily understood as possible and the adoption of a form of contract to meet conditions which are not met with in city service. This paper will be published in full in an early number of this journal.

Thursday morning was concerned with several administrative papers. That on "The Regulation of Public Service Utilities" by Geo. A. Lee, ex-chairman of the Public Service Commission of Washington, is published elsewhere in these columns, as is also Norwood W. Brockett's paper on "Recent and Proposed Legislation Affecting Public Utilities."

On Thursday afternoon Y. M. White, treasurer of

the Washington Water Power Company, spoke on **"Mechanical Devices in the Accounting Department,"** indicating the money saving possibilities of mechanical devices in cutting down clerk hire. Numerous devices of this sort were described, and the advantages of their use explained, including machines for billing, addressing, calculating, tabulating and sorting, as well as a special ledger rack.

Seattle's Business Center—Home of the Sixth Annual Convention of the N. W. Electric Light and Power Association.

Henry L. Gray, former chief engineer of the Public Service Commission of Washington, discussed **"The Valuation of Electric Utilities,"** dealing informally with the methods implied in cost of and benefits to be derived from the appraisal of electric light and power properties with particular reference to the valuation of the property of smaller companies.

A. C. McMicken, sales manager for the Portland Railway, Light & Power Company, presented an interesting paper on **"Management of a Commercial Department,"** in which he emphasized the need of careful consideration of the plan of organization of a commercial department as a prerequisite to the department's successful conduct. Three plans of organiza-

tion were outlined in diagrams, one of these being the plan in use by the Portland Railway, Light & Power Company. The distinctive features common to all three plans are that the sales manager is given supervision over light and power billing and also over service inspections, installations, meter installations and meter reading. The paper is accompanied by sheets necessary to make a complete report on any power prospect.

On Friday morning S. C. Lindsay, electrical engineer with the Puget Sound Traction, Light & Power Company, presented a paper on "**Use of Protective Relays on Transmission Systems,**" which appears in this issue. V. H. Greiser, electrical engineer with the Washington Water Power Company, treated on "**Some Features of the Washington Construction Rules.**" W. H. Lines, industrial power engineer with the Portland Railway, Light & Power Company, spoke on the "**Industrial Application of Electrical Heating,**" and A. E. Ransom, manager of the Seattle office of the Caldwell Machinery Company, read a paper on "**Electricity in the Lumber Industry.**" These will be published in future issues of this journal.

Friday afternoon O. B. Caldwell, general superintendent of light and power for the Portland Railway, Light & Power Company, presented a comprehensive paper on "**Synchronizing an Electric Light and Power Company's Records and Accounts With the Characteristics of Its Business,**" in which the author proposes a scheme of accounting to indicate the company's actual cost of doing business in its various branches. The various steps in the manufacture and distribution of power are divided into: Preparation of Source; Generation; Transmission; Transformation and Storage; Distribution; Utilization.

The operating and fixed costs obtained in the first step, are added together and the cost of source per unit is found. This is added to the operating cost in the second step which together with fixed costs is used to obtain the unit cost in this step and so on through all the steps. Under transformation and storage, the costs for railway municipal arcs, and light and power are separated and carried in parallel columns. Those costs which are common, such as time of operating superintendent, miscellaneous supplies, etc., are apportioned among the three classes.

It is assumed that the railway department of the company will take care of its own distribution and railway costs are therefore not carried beyond transformation and storage. Under utilization a division of costs is made among six classes of service, municipal arcs, commercial arcs, ornamental street lighting posts, electric signs, lighting consumers and power consumers. To quote the writer, "The resulting costs obtained by including everything down to this point, is the final cost, except for promotion, commercial and general expense items. It would be possible to include these expenses along with the expenses of utilization. * * * However, in most instances it would be preferable to make major subdivisions of these particular steps in the business for the purpose of analyzing same in detail."

The following delegates were present:

O. B. Coldwell, Portland; Lewis A. McArthur, Portland; G. G. Drennan, Pomeroy; F. Dabney, Seattle; W. J. Grambs, Seattle; C. H. Cleaver, Granite Falls; W. M. Hamilton, Salem, Ore.; C. J. Edwards, Yamhill, Ore.; R. J. Andrus, South Bend; H. A. Boring, Seattle; F. W. Killam, Seattle; H. V. Gates, E. G. Robinson, Arlington; G. E. Quinlan, Seattle; J. H. Longfellow, Y. M. White, Spokane; A. S. Moody, Portland; W. F. Haynes, Portland; W. E. Herring, Seattle; F. V. Cook, Mansfield, Ohio; H. C. Stoddard, Medford, Ore.; A. Steele, Spokane; M. W. Berkett, Spokane; E. H. Le Towineau, Portland; M. C. Osborn, Spokane; J. C. Kenkle, Portland; George Carson, Seattle; R. R. Robley, Portland; M. T. Crawford, Seattle; H. B. Pierce, Spokane; J. C. Kenkle, Portland; George Carson, Seattle; Chicago; L. V. Harper, Chelan; H. S. Wells, Portland; A. H. Jaeger, Seattle; A. O. Miller, Seattle; Ralph V. Pope, Elizabeth, N. J.; F. L. Hutchinson, secretary of A. I. E. E., New York; C. R. Collins, Seattle; Carl Bush, Seattle; F. Straight, Seattle; Burton R. Stare, Seattle; H. R. Bleecker, Spokane; A. C. McMicken, Portland; F. W. Whittington, Portland; B. W. Mendenhall, Salt Lake; F. A. Phipps, Seattle; A. E. Rawson, Seattle; A. Warren Thompson, Spokane; A. W. Mathis, Seattle; J. M. Kinkaid, Port Townsend; F. F. Fakwell, Seattle; C. R. Wallis, Portland; E. F. Osberg, Buckley; V. D. Armstrong, Seattle; H. E. Doren, Seattle; D. N. King, Seattle; I. T. Adelberg, St. Louis; B. H. Kline, Seattle; M. G. Carhart, Seattle; F. C. Brewer, W. G. Martin, Bremerton; R. W. Clark, H. G. Bill, L. R. Grant, Seattle; P. A. Bertrand, Aberdeen; J. W. Fleet, L. H. Coffin, Bellingham; M. R. Nickerson, Seattle; N. W. Brockett, Seattle; H. G. Levinski, Butte, Mont.; R. J. Quigley, J. L. Wright, W. B. Thomas, Seattle; George R. Murphy, San Francisco; H. H. Stephens, Everett, Wash.; L. E. Kurtechan, Edmonton, Canada; Fred Reeves, Wenatchee, Wash.; O. B. Ayres, Seattle; D. C. Barnes, Everett, Wash.; J. H. Moseley, Journal of Electricity, Power and Gas; T. N. Slocum, W. S. Mendenhall, Aberdeen, Wash.; F. G. Wiswell, E. R. Perry, A. P. Newton, J. W. Santee, Nina E. Woodburn, H. B. Dunn, Seattle; A. S. Hall, Hood River, Ore.; H. C. Heermans, Hoquiam, Wash.; J. B. Kelman, Astoria, Ore.; V. H. Lines, F. W. Hild, H. C. Hazzard, Portland; J. H. Siegfried, Kennewick, Wash.; G. C. Sawyer, North Yakima, Wash.; G. E. Swett, J. C. Bower, L. S. Livermore, J. C. Low, Seattle; A. M. Chitly, Everett, Wash.; B. C. Moons, W. J. McKeen, E. J. Beery, C. H. Gallant, L. V. Raymond, J. M. Laughlin, W. E. Evans, Seattle; B. P. Bailey, The Dalles, Ore.; H. B. MacPherson, A. L. Kempster, Dorothy Wilson, H. R. Miller, Carl Bush, Seattle; Douglass Allmond, Anacortes, Wash.; S. A. Hoak, J. E. Wickstrom, Ray W. Turnbull, Harry Byrne, Arthur Heis, R. E. Thatcher, Geo. B. Harrington, Geo. A. Lee, Seattle; F. O. Dolson, Portland; Jno. E. Richardson, Seattle; C. C. Turlay, Vancouver, Wash.; V. V. Vercoe, Sunnyside, Wash.; John J. Walsh, New York; D. P. Pierce, Rov. Hartley, Seattle; F. D. Nims, F. E. Harrington, Vancouver, B. C.; F. C. Roberts, San Francisco; C. H. Nelson, Aberdeen, Wash.; W. W. Thomas, Atlanta, Ga.; J. E. De Selesa, H. E. Wilson, F. J. Zorn, H. D. Brainard, Seattle; Arthur Gunn, L. M. Shreve, Wenatchee, Wash.; J. A. Kennedy, P. J. Aaron, Seattle; W. B. Hall (Pass & Seymour), New York; J. R. King, Seattle; H. A. Hart, Olympia, Wash.; O. T. F. Markhus, Boise, Idaho; S. S. Einstein, Cincinnati, Ohio; H. I. Mille, E. R. Ramser, Seattle; C. T. White, Wenatchee, Wash.; M. E. Cheney, H. L. Eicher, R. Worth, E. L. Barnes, Seattle; G. L. Oman, Portland; J. H. Whitaker, Seattle; F. N. Averill, Portland; J. L. Bradfield, W. H. Hoff, R. G. Barton, F. M. Hallock Jr., Seattle; W. P. Ellingwood, Puyallup, Wash.; R. C. Sanders, Tacoma; H. E. Shank, N. H. Silver, J. H. Harisberger, R. M. Arms, Seattle; Chas. M. Gunn, San Francisco; C. P. Hilliard, W. B. Seyden, E. A. Norton, Seattle; B. A. Collins, Tacoma; F. D. Mandy, Danah Corbet, Seattle.

Electrical precipitation of dust from the kilns of the Riverside Portland Cement Company at Crestmore, Cal., now makes possible the operation of the plant, which the farmers in the vicinity threatened to close permanently because of the damage to vegetation from the dust. The method is a modification of the Cottrell process for the precipitation of smelter fumes. The sale of the dust for fertilizer purposes pays the cost of operation, about ten carloads being shipped weekly to the citrus fruit growers.

THE REGULATION OF PUBLIC SERVICE UTILITIES.

BY GEORGE A. LEE.

In recent years, and within the past three years in Washington, the regulation of public service utilities has become a well defined governmental policy. I will not attempt to dwell at length upon the general conditions and abuses which inspired this regulatory legislation. Suffice it to say that the desperate competitive struggles of the old days, the unlawful concessions, privileges and favoritisms, the various abuses practiced and the insidious rebates and contracts have largely, if not entirely, disappeared. It will be admitted by all fair minded students of the old regime, that many of these practices now forbidden, were created and indulged in by virtue, if not by force, of the then existing political and economic conditions. While many utilities, anxious to secure revenue and protect investments, voluntarily and willfully engaged in questionable practices, yet it is also a fact that many were forced to do so by corrupt governmental agencies, controlling franchises and other governmental privileges necessary to corporate existence and prosperity. The new regime makes unnecessary a further discussion of old conditions. Times have changed, abuses have been removed, evils have been rectified and the law has thrown its protecting mantle over both the consuming public and the public service corporation.

Let us briefly consider the benefits and advantages arising from public service regulation properly and efficiently conducted. Public service commission, if composed of fearless, reasonable and fair minded men, are a great benefit not only to the various communities, but also to the various utilities regulated. The commissions act in many instances as arbitrators between the public on the one hand and the utilities on the other, and after careful investigation are able to and do settle innumerable disputes, some of a petty and minor, and some of a grave nature, thus avoiding friction and litigation, and establishing and directly creating a better relation between the public service company and its patrons. The mere statement of this benefit is self-evident and requires no further exposition.

Another benefit flowing from public service regulation is the fact that frequently the company is sustained in its contentions with reference to various complaints. Frequently a patron or consumer is unwilling to believe that there is a company side to the controversy. By intervention and investigation the public service commission often finds that the complaint is unfounded. The complainant is so advised, and having had the opportunity of appeal to an impartial and unbiased state tribunal, is satisfied, the dispute is closed, the controversy ended, and a better feeling established. This is frequently done by commissions in what would seem to be small and minor matters, but the disposition and proper settlement of these minor questions means the establishment of the good will of the patron, and such good will is a valuable asset.

Again, and unquestionably one of the most important benefits arising from the system of state regulation, is the fact that public service utilities are gradually, but certainly and permanently, being removed from the sphere of local politics. Heretofore, in this and other states, public service companies have frequently been compelled to be, so to speak, "the football of municipal politics." Many of the unlawful practices above mentioned as having existed under the old regime, were directly created and encouraged by this unsound, unwholesome and frequently pernicious municipal regulation. It must be apparent to all fair minded students of the problem that so long as local prejudices, jealousies and influences control in the regulation of public service corporation, such regulation can never become effective or wholesome.

Washington in favoring and strengthening the public service commission and state regulation by legislative action, realizes the advantages and benefits to flow therefrom, and in rejecting the so-called home rule idea, or local regulation of public utilities, is simply keeping step with the great states of New York, Wisconsin, Massachusetts and others where home rule has been tried and tested, found woefully wanting in merit, and rejected. This removal of utilities from municipal politics and regulation by state commissions should be a continuing governmental policy in the state of Washington, and to that end we should all bend our energies and vigorously assail those municipal agitators and other insidious foes who seek to destroy the present system and restore the old regime. This removal of utilities from municipal politics means better service and better rates on the one hand, and on the other a security of investment and statutory and constitutional protection to the utility.

Another fundamentally important benefit arising from state regulation and from commission control generally, is the fact that such regulation is the reasonable alternative of public control and ownership. Such regulation affords and secures all of the benefits and advantages incidental to public ownership without the dangers, experiments and disadvantages incidental thereto. If such regulatory legislation secures for the people good service, reasonable rates and safe and efficient facilities, then certainly there can be no logical or convincing argument in behalf of the surrender of such efficient regulation for the experimental and dangerous plan and principle of municipal or state ownership. Lack of time prevents further discussion of this situation.

It is apparent then, in considering the benefits and advantages of regulation hereinbefore enumerated, that the passage of public service commission laws in the last few years marks a new regime, gives to the public that service and those rates to which they are entitled, gives to the companies that protection and that rate of return which the constitution and the fundamental laws of the land require, and at the same time avoids the dangers, pitfalls and expensive experiments of municipal regulation and municipal ownership.

Considering now another phase of the subject, we naturally inquire, what are the pitfalls and dangers of state regulation? Manifestly, this inquiry presents an important field. It may be admitted that efficient, capable and honorable public service commissioners can and do render important and valuable service to the state and to the utilities. If, on the other hand, the members of the state commissions lack courage and integrity, and attempt to prostitute their positions and

immense powers for ulterior personal or political ambitions, then in that event the entire superstructure of regulation falls and such regulation becomes a mere fiasco.

Politics have no place in public service commissions. The members of these commissions should be men of fine ability and integrity; of fearless and judicial temperament; otherwise the failure of the work will be just as great as municipal control has been in the past, and the fundamental vice of municipal control rests, of course, in the politics of the situation. Permanency in office is also highly necessary.

Another danger of public service regulation is the fact that many commissions are not able, or are unwilling, to take a broad, fair and reasonble view of the problems confronting them. If, for instance, values of public service properties are placed low in order to satisfy popular clamor; if the law and the facts of the case are ignored; if unfair, unreasonable and confiscatory rates are imposed and ordered, and if, generally speaking, the utilities are not accorded those rights, privileges and protection to which the law and the constitution entitle them, then the dangers and pernicious results of such regulation outweigh all the advantages and benefits outlined above.

Recently, in Washington, D. C., in conversation with the chairman of a certain public service commission of one of the Mississippi Valley states, he stated to me that in no event should capital invested in public service properties be entitled to a greater net return than two per cent. The only argument which he presented in favor of such a statement was that capital, both active and inactive, in the United States averaged no greater rate. This commissioner either overlooked or ignored the speculations, hazards and dangers incident to many investments in public service properties. He apparently forgot that capital is frequently sunk in these enterprises for many years before any returns are received. He forgot that many of these great industries are constructed years in advance of the time and that large cities are frequently made possible by the foresight judgment and wisdom of investors in public service properties. In all other industries these facts and factors are rewarded; why not in the public service business? I answered him by saying that the courts, both state and federal and the most eminent commissions of the United States had almost universally held that any net return under six per cent was unreasonable, confiscatory and unconstitutional. His only reply was that the courts and commissions were wrong. I cite this conversation to show what I mean by one of the very great dangers of public service regulation.

Another danger of public service regulation which I will mention without discussing at length, because it is a subject which might well engage one's attention for a considerable time, is the unnecessary and unjustifiable duplication of public service properties. While we have an admirable public service commission law in this state, yet the absence of this fundamental economic principle, prohibiting duplication of public service properties, is regrettable. It should by all means be incorporated into our statute at the next session of the legislature. Wisconsin, New York, Massachusetts, California and other states which have successfully regulated utilities have all recognized the necessity of avoiding the expensive, wasteful and disastrous duplication of public service properties. A certificate of convenience and necessity law should engage the careful and thoughtful attention of the next legislature and should be placed on the statute books. A careful study of court decisions, opinions of eminent public service commissions, and writers and students of the subject, discloses in a convincing manner, that the trend of modern, progressive thought, with reference to the regulation of public service corporations, is to discourage and prevent unnecessary and wasteful duplication of plants.

The regulation and control of public service corporations supplying light and power in the State of Wisconsin is conceded by all to be the most satisfactory and efficient of any state in the Union. In no other states does the public receive better service; in no state are the rates more fair or reasonable. Beyond question, the one chief reason for good service and reasonable rates in Wisconsin consists in the fact that utility properties serving the public have not been duplicated at random. In Wisconsin, before a light, power or other company can start business in any municipality, a certificate must be secured from the state showing that public convenience and necessity require the new service. In other words, if a light and power company is serving a community efficiently and at reasonable rates, and the locality is not large enough to support another competing plant, the right of such competing company to enter is invariably denied. Experience in Wisconsin and other states has abundantly demonstrated that unrestricted competition in the public service field has resulted ruinously to the public.

Permit me to suggest in these concluding remarks, and to impress upon all the necessity of maintaining a cordial relation with the regulatory bodies. There should be co-operation and every effort made to extend efficient service. The question of rates is ordinarily secondary and inferior. If the requirements of the public service law are fully met by utilities, then regulation will not only be wholesome, but agreeable to all parties concerned. I simply suggest this thought without further analysis or discussion. If time permitted, I should be pleased to discuss at greater length some of these important questions which I have simply touched upon. It may be interesting to repeat the remarks made by Hon. John M. Olmstead, who recently retired from the Public Service Commission of New York, and who, in discussing the subject, "What Regulation Taught One Regulator," said:

"I came into office with a decided leaning toward anti-corporation views of public utility questions. Experience has taught me that there is another side to these questions, and one not lightly to be dismissed. I have changed my mind also as to the attitude of most corporation managers toward the public. The difficulty with me has not been so much in getting the companies to do what I thought was right, as to determine in my own mind what under all circumstances of certain cases was right.

"I believe that in the past ten years a great change has come over the minds of men who are in the management of public utilities. There are still some left who cling to the old 'public-be-damned' idea, but they are fast being sup-

planted, and the up-to-date railway or electric light official stands ready to listen to any reasonable complaint that may be brought to his attention, and, what is more to the point, to turn a deaf ear to proposals which call for abhorrent and forbidden methods in their accomplishment. I am not innocent enough to believe that all the dark, devious and easy ways of 'getting there' have been wholly abandoned; but I do hold the view that the street called 'Straight' is a much more popular thoroughfare than it used to be, and that the directors and agents of the corporations over which we have control are walking it with much cleaner consciences and with great gain to their self-respect."

It is unnecessary for me to say that I fully share the views of Commissioner Olmstead. A somewhat extended experience on the Public Service Commission of Washington convinced me that the utilities of the state are meeting the regulatory legislation of the state in a fair, honest manner. They fully realize that their business is impressed with a public use and that the consuming public is entitled to certain legal rights. On the other hand, experience has shown that the average citizen is reasonable, and that if relief is denied by the commission the complainant is generally satisfied. The greatest enemy of public service regulation today is the unfair and unscrupulous municipal agitator, desiring political or other preferment, and appealing to the sympathies and prejudices of the people. The people cannot always be misled, however, and are rapidly coming to recognize and appreciate that there are two sides to the controversy, and that equity and fair treatment must be accorded the utility if the community is to progress and prosper.

If time permitted I should be pleased to discuss the importance and necessity of state regulation of municipally owned utilities. The attitude of the Wisconsin commission upon this question is interesting and instructive, especially so since the regulation of public service corporations in the State of Wisconsin is concededly the most successful and efficient of any state in the Union. Chairman Roemer of the Wisconsin commission says:

"A distinctive feature of the Wisconsin law is that of placing all municipal plants under the supervisory powers of the commission to the same extent as privately owned plants. The wisdom of this policy is no longer disputable, for no greater benefit has been bestowed upon the public by regulation of public utilities than that resulting from the operation of the law upon municipal public utilities. . . . The systems of accounting, etc., prescribed by the commission have met with the approval of those in charge of municipal plants who have endeavored to administer the affairs of the city upon a sound business basis, etc."

Discussing the regulation of municipally owned plants, Commissioner Erickson, a distinguished member of the Wisconsin commission, recently said:

"It is a fact that they need regulation fully as much and even more than privately owned plants. Relatively more complaints are received affecting municipally owned plants than privately owned plants.

"Their rates are often discriminatory to a greater extent than is the case with privately owned utilities. The rates are put in apparently in a haphazard way, without much regard to cost of the service, and often largely for political reasons. That is also true of the service. That is, the service, while at times good, is frequently open to very serious objection. I am not making these statements because of the fact that the matter is discussed and is of a controversial character, but I am making them simply because they are the facts. There are very few municipally owned utilities in the state that have not been hauled up before the commission at least once, and in going through their records it is very difficult to get any line on their business. They usually keep their accounts mixed up with other business of the city. Everything goes into the general fund, and the money received from the utility is often used for any purpose that the city officials may choose to use it for. Incomplete or no records are made of the amount of water or current used by the city. There is often no reliable way of telling either the quantity or the service furnished or what has been received for it. . . The administration of the plant is usually changed with changes in the administration of the city, and instead of there being an engineer or somebody who has had experience in charge, they often put a good politician in charge."

The experience of Wisconsin and other states in connection with the regulation of municipally owned plants might well and profitably be followed in Washington. This subject is one of fundamental importance which the next session of the legislature in this state should consider. If the state is to require the regulation of public service corporations privately owned, then let it be consistent in its governmental policies and regulate in like manner municipally owned plants, especially in cases where they compete strenuously and constantly with privately owned plants. This doctrine is not new, alarming or revolutionary. It is predicated and based upon fair play just as in the State of Wisconsin. If privately owned plants are to be regulated, investigated and controlled, then by farity of reasoning and by all of the logic of the situation, municipally owned plants should not escape the same requirements.

As the Supreme Court remarks, the regulation of public service corporations is a delicate and dangerous function and ought to be exercised with fairness and justice. I have an abiding faith in the sound judgment of our Western people. Their spirit of fairness is always dominant. The great issues above suggested can never be settled until they are settled right. On the one hand, let us demand of the public service companies that they serve the public fairly and efficiently; that their rates be reasonable, consistent with their investment and hazards; that they faithfully discharge their trust as public agents and almoners of public necessities. On the other hand, let us insist that fair and honorable treatment be accorded these utilities. Let us all do what we can to remove them from the sphere of petty politics and local jealousies. Let us educate our people to the fact, so well expressed by the Supreme Court of the United States, that our social system rests largely upon the sanctity of private property and that utilities, as well as all others, are entitled to a fair compensation for their service, their risks, their investments.

Let us meet and solve these fundamental problems in a calm, judicial and dispassionate manner. Let us all, regardless of political creed or business connection, regardless of personal or sentimental considerations, earnestly seek the law and the facts. And, finally, let us remember in our efforts to adjust and settle these grave economic, financial, industrial and social questions that equity and fair play should be accorded equally and without discrimination to all public service corporations, as well as to all citizens.

USE OF PROTECTIVE RELAYS ON TRANSMISSION SYSTEMS.

BY S. C. LINDSAY.

Practically all classes of business and all phases of our domestic life have become dependent upon electric energy to such an extent that an interruption for even a few minutes to the main source of supply to cities or districts dependent upon it, is a small sized calamity.

The obligations of public service corporations to maintain their supply of energy without interruptions to customers or districts they have undertaken to serve, have ceased to be a matter of mere business policy and have become a public necessity.

Companies serving exclusively from steam plants and having storage batteries floating on their direct current systems, have apparently not realized until recently the serious problems involved in getting protective apparatus for their alternating current systems, which will afford a continuity of service approaching that of the direct current systems.

Companies operating water power plants and transmission lines have long recognized the complete inadequacy of the protective relay apparatus supplied by the manufacturing companies, but have apparently contented themselves by saying, "Oh! Well, we have a water power plant and long distance transmission lines, and we are bound to have interruptions," and have let the matter go at that.

It is a problem of so arranging transmission lines and feeders and adjusting the protective apparatus controlling them, as to obtain selective action. Mr. L. L. Elden, in a paper presented before the American Institute of Electrical Engineers at their Boston meeting, July, 1912, called attention to the fact that there "had not been any material change in the construction or commercial application of this class of apparatus for a good many years."

Looking a little into the history of protective relays for generating transmission and distribution systems, the writer finds that the clock type time limit relay was brought out in 1898 and the bellows type inverse time limit and definite time limit relays were brought out in 1900 and 1901. About five years later a watthour meter type of relay was brought out using permanent magnets and electro-magnets on a rotating disc to produce the time element. These relays were made with the overload and reverse current features in the one instrument, also to operate on reverse current or reverse energy only.

Notwithstanding their advantage over the types previously mentioned, they have not been used extensively. About six years ago the writer realized the complete insufficiency of the then existing protective relays to give selective action on networks and ring systems, and began hammering at the manufacturing companies for apparatus to meet the above requirements. The responses were at first discouraging. In the meantime several eastern companies, which were having their troubles with protective relays, took the matter up seriously with the manufacturing companies, with the result that there is on the market today protective relay apparatus, which when intelligently selected and carefully installed and adjusted, will give a degree of protection on networks and ring systems considered impossible a few years ago.

The extensive use with excellent results of the Merz-Price system of pilot wire relay protection in England has brought the operating companies in this country to a realization of its possibilities, and with certain improvements, it is rapidly gaining favor in this country notwthstanding its expense.

Most protective relays in use up to the last two or three years have been crude, to say the least, when we consider the class of apparatus to be protected and the class of business to be served. The ludicrous part of the whole situation is, that intelligent engineers expected to adequately protect generating and transmission equipment costing hundreds of thousands of dollars and serving the largest and most important classes of business with a set of protective relays costing about thirty dollars each.

Adequate relay protection is largely a matter of cost, and the well known law of economics, that you can't get something for nothing, applies equally as well to this problem as to others. Nevertheless, operating companies have been trying to get something for nothing when they expected protection from the relay apparatus formerly used. For lack of progress in this matter, operating companies alone have themselves to blame. Last year the company the writer is connected with decided to remodel its entire protective relay system with the idea that each line or other piece of apparatus would be so protected that any unit having a fault would be automatically disconnected without causing undue disturbance to the system.

We submitted our problem to the manufacturing companies without specifications, merely telling them what we wanted to accomplish and asking them to submit a complete protective relay scheme that would meet our conditions.

Fig. 1 shows the various substations and transmission lines, with all connections and apparatus involved in the relay problem. Symbols representing the different kinds of relays are placed near the switches they are to operate. The relay scheme as shown is practically the same as submitted by the company which got the order. They made some further recommendations which we favored, but did not adopt because changes in the near future would render them useless. The cost installed, of the complete scheme as submitted would have been $18,000. As adopted it will cost $5,000 installed. This illustrates the extent to which problems of vital importance sometimes remain unsolved, because operating companies have not attacked them early and prosecuted them vigorously.

From the variety of relays now available, extreme care should be taken to get the right relay in the right place. The following list of relays meets a variety of conditions:

Instantaneous overload.
Inverse time limit overload.
Definite time limit overload.
Selective time limit overload.
Instantaneous reverse current.
Reverse current inverse time limit.
Reverse current definite time limit.

Overload and reverse current, or reverse energy, combined in one relay, limited inverse time.

Reverse energy, limited inverse time.
Reverse energy time limit.
Reverse energy instantaneous.
Pilot wire.
Instantaneous differential.
Balanced power.
Low voltage release a.c.
Low voltage release d.c.

A few general rules for the application of relays may not be out of place here.

Distribution circuits should be protected with instantaneous or inverse time limit relays, depending upon the character of the load to be protected. Radial transmission lines, or lines that have only one substation, or loads of similar character, should be protected with inverse time limit relays in the station where they originate. As a rule it is not necessary to make them automatic at the receiving end.

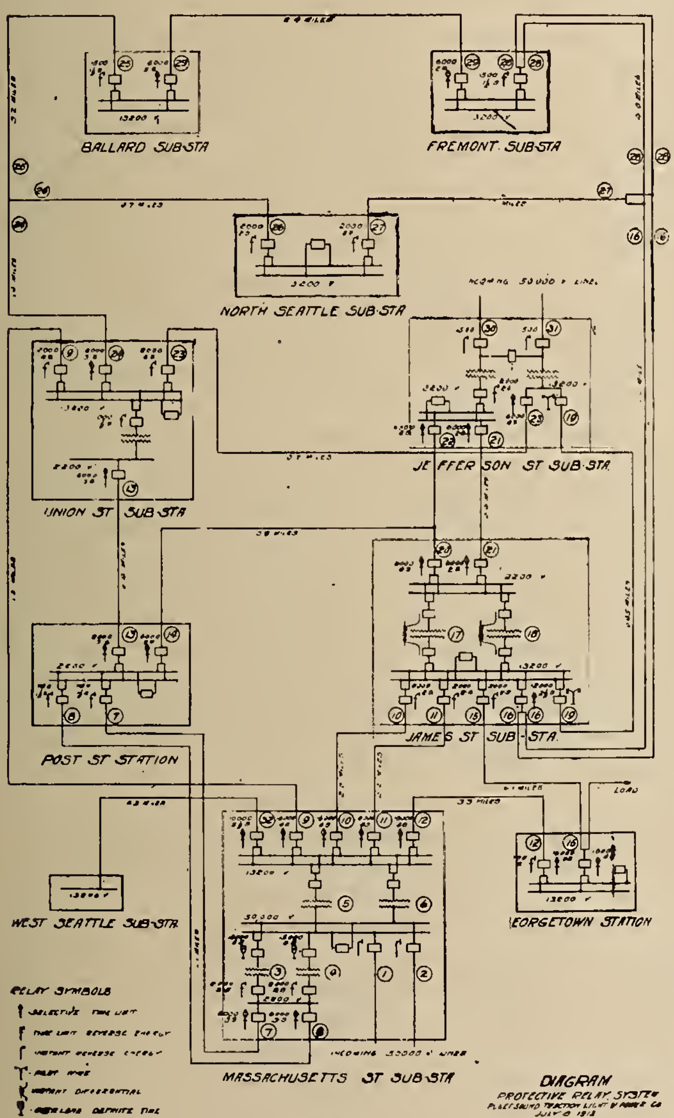

Fig. 1

Where two or more lines deliver power to the same load, or substation, time limit or instantaneous reverse energy relays are used at the receiving end and selective time limit relays at the generating or originating end.

Pilot wire relays are recommended for feeders in ring systems and networks, also for tie line feeders between stations where power is fed in either direction in equal amounts. They are used when not too expensive.

Instantaneous differential relays should be used on transformer banks where two or more banks are paralleled on both sides.

Inverse time limit or definite time limit relays should be used where there is only one transformer bank and the secondary side is unconnected with any other source of power.

The above remarks are quite general and a complete relay scheme for any system should not be adopted until a careful study of it is made.

Next in importance to selecting the right relay for the right place, is the proper load and time adjustment of all relays on a system. In response to inquiries, one large eastern company states that it sets its relays on its transmission lines leaving the generating station for a maximum time of 1½ seconds, and

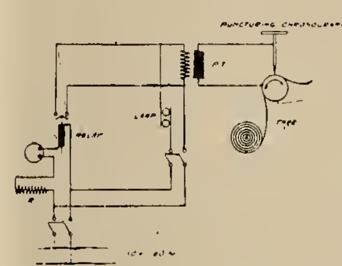

Fig. 2.

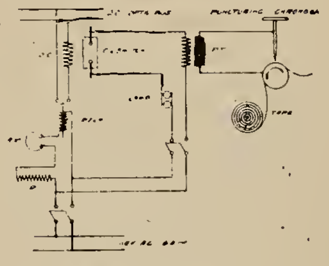

Fig. 3.

the relays in the first, second and third stations the line passes through are set respectively ½ and ¼ seconds shorter time. The switch in the substation furthest away from the generating station being set for a maximum time of ¼ second. The above settings do not include the time lag of the switch, which in this case varies from 0.4 to 0.6 of a second. Any time setting of a relay should include the mechanical time lag of its switch.

In order to determine the time characteristics of existing relays and switches, the writer borrowed an idea from Mr. Schuschard, of the Chicago Edison Company, and built a puncturing chronograph or cycle recorder. It is simply a cylinder phonograph with a few changes and additions, so arranged that it will drive a strip of paper at a uniform rate of speed, over a metal cylinder. Mounted above the cylinder and in line with the center of the paper, is an adjustable needle point. The 2200 volt side of a small potential transformer is connected, one pole to the cylinder and the other to the needle.

A diagram of connections for the complete apparatus is shown in figures 2 and 3. The recorder makes two punctures per cycle, one at the peak of each wave and to get the time in seconds of a given operation, it is only necessary to count the punctures and divide them by 120 when using 60 cycle current.

In timing the operation of apparatus with this instrument, we took six readings for each condition and the average number of punctures for the six trials was taken as its correct time. This was done to eliminate the small error due to speed variation.

Seven types of switches were timed, the results are shown in Table 1.

TABLE 1.

No. Switch.	Type.	Amp.	Volts.	Poles.	Control.	Lag. Time
						.08
1						
2	K-4	300	15,000	3-S-P	Solenoid	.11
3					Operated	.13
1	K-12	300	15,000	3-S-P	Soleniod	.10
2					Operated	.14
1	G. A.	300	66,000	3-S-P	Solenoid	.08
					Operated	
1						
2	C	300	30,000	3-S-P	Solenold	.28
3					Operated	.22
1	H-3	1200	6,000	4-S-P	Motor	.20
2					Operated	.24
1	H-3	400	50,000	3-S-P	Motor	.26
1		300			Operated	
2	H-3	500	15,000	3-S-P	Motor	.07
3					Operated	.12

The quickest opening switch requires .07 second and the slowest .28 second. The five slow opening switches are old ones installed in 1904-5. The others were installed within the last four years.

Tests were also made on the three principal types of relays we have had in use, viz:

Bellows type D. P., inverse time limit.

Bellows type D. P., definite time limit.

Watthour meter type, single pole, inverse time limit, reverse energy, without the overload feature.

The bellows type relays were tested to determine the minimum time required by them to operate and close the trip coil circuits of oil switches. They were made as nearly instantaneous as possible by removing the air valves. From these tests one on each pole of three definite time and two inverse time limit relays under a variety of conditions, it was learned that the shortest time in which they closed the trip coil circuit of oil switches was .05 seconds. Adding this to the time lag of the switches, the nearest we could approach the instantaneous opening of the fastest oil switch was .12 seconds and .33 seconds for the slowest.

Another test with an inverse time limit relay set for 5 amperes and 4 seconds, closed the tripping circuit in .5 seconds when a current 12 times the original current, or 60 amperes, was applied, showing that inverse time relays become almost instantaneous under short circuit conditions.

When inspecting and checking bellows type relays on our system, we have observed that for the first application the current has to be increased appreciably after they have stood several months without being operated, to make them operate in the same time for which they were originally set.

The following tests showing the performance of a number of relays, gives some interesting results:

The tests on relays 1 and 2 were made with .5 ampere more current than was used in the original setting, because we have found in checking relay settings that the exact current used in the former setting very often will not operate the relay in less than thirty seconds after they have stood unoperated for several months, and occasionally will not operate them at all. Had the test load then applied 9 or 10 times previously, 8.4 amperes would have operated them in four seconds. We have found this condition so frequently that we know it is characteristic of the bellows type of relay.

The test on relay No. 3 was made after it had been operated a considerable number of times with 12 amperes, but without changing its load or time setting. The large difference in time as set by stop watch and as taken by the puncturing chronograph, is probably due in part to error in the original setting and in part to the previous operations at 12 amperes.

The performance of relay No. 4 agrees so closely with its original setting for both time and load, that comment is unnecessary. A further series of tests were made with this relay with three, four and five times the original setting, six readings for each overload condition being taken. The time variation for each condition agreed very closely with the variation shown in the table. Its time performance throughout the tests was very uniform.

The writer believes that some form of wattmeter type of relay will have to be used wherever close adjustments for time and load are required. With the older types of switches and bellows relays, ¼ second time between the various relays on a system does not mean much, as the relays cannot be depended upon to perform in accordance with the settings. All other classes of apparatus are tested under operating conditions, so why not test relays in the same way? They are of equally as much importance and if progress is to be made in the design and application of protective relay apparatus, it should be tested after its installation by applying short circuits to the system under conditions that will permit observations of its performance to be made.

The object of the writer is to call the attention of operating companies and engineers to the necessity for giving careful attention to this subject and to point out some of the defects in the existing apparatus. This subject opens up a broad field for investigation, as continuity of service depends upon protective apparatus that will localize and disconnect from the system any unit, having a fault, without disturbance to the system and with minimum damage to the unit. A system of checking and inspecting apparatus of this kind at frequent intervals should be adopted if its performance is to be depended upon.

RECENT AND PROPOSED LEGISLATION AFFECTING PUBLIC UTILITIES.

BY NORWOOD W. BROCKETT.

There has long been an opinion that every branch and combination of business had a right to be heard before legislative bodies, except public service companies, and that the appearance before a legislative body of a public service corporation representative meant corruption of the members and disaster to the people. I presume that a belief so wide spread must originally have had some justification in fact, although I have never been able to determine why one who appears before a legislative assembly urging measures to harrass and retard the development of public service properties should be termed a "public minded citizen" while one appearing in defense of such companies should immediately be branded a "lobbyist."

The constitution guarantees to every man the right of petition to the legislative body and he can make his petition in any way he sees fit so long as he is honest about it. To say that an association representing upwards of $500,000,000 has not the right to be heard before legislative committees upon measures

deeply affecting the properties of its members, or to assert that individually or collectively these members have not the right to explain their side of the situation to the individual members of the legislature is unjust and unsound, and I maintain that the attorney who reads a brief for his client before a legislative committee is engaged in just as honest and just as clean a labor as the one who reads it before a court or a jury. Any proposed legislation which cannot stand the test of honest criticism and a fair presentation of arguments against it is certainly not the kind of legislation which the people of these states desire or ought to have enacted into law.

It seems to me that the same test should be applied to lobbying as to every other line of human activity; that it should be fair, that it should be honest and that it should be done entirely in the open.

Probably the most important act passed by the Washington Legislature affecting electric light and power companies was the electrical construction code. This was a subject concerning which the members of the legislature knew absolutely nothing and the bill as originally introduced was prepared by the electrical workers union and naturally contained only their views and ideas. We appeared before the House committee and after arguments were instructed to get together with the labor people who were present and attempt to frame a satisfactory measure since, in the opinion of the House committee, some such law should be enacted. The bill is the result of ten days continuous conference and is entirely a compromise measure. It was passed exactly as this joint conference of central station men and linemen drew it and is to my knowledge a complete answer to any criticism concerning alleged lobbyists. It was a technical subject concerning which the members of the legislature knew nothing and they were practically compelled to refer it to the representatives of the companies and labor who were upon the ground. In reference to its workings, a hardship may arise from the fact that it does not give the small companies sufficient time in which to change their existing construction, but I feel absolutely confident that when this work has been changed by the larger companies that the smaller companies can, if necessary, get an extension of time from the legislature four years from now. There is no desire on the part of the average legislator to confiscate property and for that reason I feel assured the extensions could be obtained for the smaller companies.

The legislature repealed that portion of the public service commission act which made it obligatory upon the tax commission to take a valuation for taxation purposes which should not be less than that found by the public service commission for rate making purposes.

A determined effort was made in the Washington Legislature, principally by the city officials of Seattle and Spokane, to obtain the so-called "home rule"; the object being to take from the public service commission its powers of regulation over electric light and power and street railway properties and vest it in the local city councils. The issue was squarely presented before the Senate Committee and was urged by a strong representation of city officials from Seattle and Spokane and was opposed by representatives of the public utilities. It is worthy of note that not one representative of the general public or any commercial body was present to urge the adoption of these bills. Their entire support came from the city officials, whose powers would be increased by the change in method of regulation. After listening to all the arguments and holding the bills under consideration for some length of time the committee reported that they be indefinitely postponed and their report was adopted in the Senate by a vote of 31 to 11.

The following bills were introduced in the Washington Legislature and failed of passage. I mention them merely that you may know the character and trend of some of the proposed legislation:

A bill to prohibit the sale of electricity, outside of the state, which had been generated by water power within the state.

A bill to compel the heating of all street cars, including both vestibules, during certain seasons in all parts of the state. When it was explained to the author of the bill that the public service commission at this time have such power the measure was dropped.

A bill giving to the public service commission the right to compel the extension of street car lines into new territory. This bill authorized the city council to tender a franchise for an extension to an existing street railway company holding a franchise and if the company refused to accept such new franchise and build such extension then the city council could appeal to the public service commission, which, after a hearing, would have the right to force such extension. The bill nowhere provided, however, that in the event the company should apply for a franchise for an extension that it could appeal to the commission upon the refusal of the council to grant it. The friends of the bill refused to permit it to be amended so as to make the right of appeal reciprocal and the members of the committee refused to report it out favorably without such amendment.

Two tax bills failed of passage; one submitting an amendment to the constitution permitting class assessment, by changing the wording of the constitution, so that only various classes of property were required to be assessed uniformly; the other placed all public utilities under the state tax commission for the purpose of taxation.

The following bills were passed and enacted into law by the Oregon Legislature:

Workmen's Compensation Act. This act differs in many important particulars from the Washington act. It makes it optional with the employer as to whether he will come under the act. If he does not, however, he is deprived of practically all of his defenses in an action for damages to his employes. It also provides for the collection of one-half of one per cent of the fund from the employe and one-eighth of one per cent from the State.

A bill providing that ten hours shall constitute a day's work in all mills, factories and manufacturing establishments, but that employes may be permitted to work as many as 13 hours in any one day provided they receive one and one-half times the regular wage for all hours in excess of ten.

House Bill 414, which is an act generally remodeling the tax laws of the state of Oregon, was passed.

House Bill 415: In its general effect, the act does not require any change in the method of assessment of public utilities by the tax commission as they have heretofore been assessed. The act does, however, validate the methods pursued by the state tax commission heretofore in making assessments which have been found not to be fully covered by the law heretofore existing.

Senate Bill 47, requiring the use of electric head lights by each corporation operating any line of railway with more than fifty miles of track within the state of Oregon.

House Bill 434 is a blue sky law and is too long to be analyzed here, but it is not anticipated that any corporation engaged in legitimate business on a solvent basis will be subject to any inconvenience by complying with the provisions of the act.

The principal law enacted by the Idaho Legislature affecting public utilities was the Public Service Commission Act. There is one noteworthy difference in this act and the public service commission laws of Washington and Oregon in that Idaho has followed the example and experience of the eastern states and has incorporated the certificate of convenience and necessity in the law, giving its commission the power to protect a company which has pioneered into a new field from unnecessary competition where the existing company is giving adequate service at a fair rate.

Concerning future legislation—and I approach this subject without hesitation or without fear, as I maintain that we have the same right to seek just and fair laws for the protection of our property as any other individual or industry within these states. We have the right and in a large measure it is our duty to state our position frankly and without equivocation to the people at large and to those to whom they have delegated the law-making power. No company has the right in my opinion to enter into politics or to assist in any way whatsoever the election or defeat of any candidate for public office, but it unquestionably has the right, guaranteed by the constitution, to submit its case to such officials when elected.

I hold no brief for the public service commission, nor any individual member thereof, but I earnestly assert that experience has proven that the only method of regulation of public utilities fair to the people, to the state and to the companies, is the regulation by a state body. The complainants in the very nature of things cannot also be the judges and no city council, I care not how fair its members may be, can give an unbiased judgment and decision upon questions affecting public utilities within the limits of their own city. I also believe that the experience of Wisconsin, Massachusetts, New York, California and a score of other states has demonstrated without possibility of contradiction the wisdom and necessity of vesting in the public service commission the power to refuse a franchise to a competing company where the territory is being adequately served by the existing company at a fair rate. Duplication of plants necessarily means a duplication of capital, upon which the consumer must pay a return. It is not necessary to go beyond the city of Seattle to prove this. A competing gas franchise was granted some ten or twelve years ago; duplicate plants were erected and duplicate mains laid over miles of the streets of Seattle; in due time the plants were consolidated with the result that the tax assessment of the company is abnormally high, considering its gross income, caused by the duplication of plant and service mains. When this plant is valued by the public service commission for the purpose of rate-making, this duplicated value will unquestionably have to be taken into consideration, at least to some considerable extent, and the rates fixed at a figure which will earn a return upon the entire investment.

I realize that the question of municipal plants is one that must be touched upon with the greatest caution, but I am unable to see why the taxpayer, whose property is bonded for the construction of such a plant, and who is taxed to pay the interest and other charges for its maintenance and operation, should not demand the same scrutiny in the conduct of its business that he requires in that of a privately owned property. It appeals to me that such a state commission, acting in a measure as a board of audit over the expenditure of his money in the plant and as an arbitrator to see that individuals who appear to be especially favored are not given undue preference in the matter of rates and service, would be a splendid protection to the citizen. This is a matter which is not going to be decided either by interested companies or, on the other hand, by the city officials, who are managing the plants. The issue should be placed squarely before the people. They should be told without prejudice and without misrepresentation just what public service commission control means, just how much it may hamper the operation of their plants and just to what extent it will safeguard their investment. When this is done I personally have no fear but that the people themselves will demand in no uncertain voice that their plants be placed under the public service commission and the officials operating them under the control and supervision of that body.

APPLIED MATHEMATICS.

I sometimes wonder what's the use
Of squaring the hypotenuse,
Or why, unless it be to tease,
Things must be called isosceles.
Of course I know that mathematics
Are mental stunts and acrobatics,
To give the brain a drill gymnastic
And make gray matter more elastic—
Is that why Euclid has employed
Trapezium and trapezoid,
I wonder?—yet it seems to me
That all the Plain Geometry
One needs, is just this simple feat,
Whate'er your line, make both ends meet!

—Anne W. Young, in Harper's Magazine.

A FAIR FIELD FOR A BROADER MARKET.

BY ERNEST FREEMAN.

Team work wins whether the game be baseball or business, and the larger the ratio of team work the happier and more profitable will be the results to both the team and the indiviluals on it.

The Society for Electrical Development exemplifies to my mind the ideal of team work for the development of the electrical industry—and for the immediate and ultimate profit of all engaged.

The very broadness of the plan makes it perhaps difficult—for one who has not been gifted with what might be called "a national vision"—to grasp just how the individual smaller interest will secure a direct profit from the work. That is, until the whole scope of the various plans are considered—then it is very clearly to be seen where the dotted line works directly into one's own profit sheet.

It's a good deal like the feeling connected with the winning of a team cup. We have a sort of feeling of pride in being on the team—it's a fine thing to see the cup on the club's mantle—but somehow each member would rather have received a smaller individual cup for his own individual sideboard.

The "personal sideboard" and its relation to the work of the Society is what we as individual contracting concerns must consider.

The complete plans of the Society have been published—so as contractors believe that the work will be of direct benefit to the industry and to us individually as contractors, and beyond the national advertising, the publicity work in newspapers, magazines, the moving picture, electric sign exchange and other ways as planned, and in the field work, do we see a certain and direct individual profit very much in excess of the relatively small proportionate share which we are subscribing to the movement. Beyond all this we have a vision—a vision of harmony in its highest form.

Harmony as we see it is a distinctly practical business proposition, to not only ourselves, but to the central station, the jobber and the manufacturer, who go to make up the industry in which we are all doing a distinctly related business.

"Related," we say, but there is case after case where the relations are strained—strained to a point where it is the belief of all that the sale of sockets, wire conduit, lamps, motors, fans, irons and all classes of supplies and appliances, and of electric current is being actually hindered. Where the friction between the various interests engaged is of immense loss to us all.

And this friction is chiefly caused by lack of understanding of each other, and perhaps lack of perspicacity in merchandising.

It seems logical to believe that the more live people or concerns there are pushing electrical goods—the more electrical business will be done.

We all know that in the cities where harmony is—there is the constructive development of the industry at its greatest to the mutual profit of all concerned.

What will the Society for Electrical Development do to help?

The answer lies in three brief paragraphs quoted from the Society's booklet, "What does the Society for Electrical Development Mean to Me"—and if the Socity would do nothing further for the industry than to accomplish the purpose thus set forth, it will have more than earned the subscription of not only the contractors, but of the central stations, jobbers and manufacturers.

"Reducing Friction; Promoting Harmony."

"In cities where the central station policy is not to the contractors' interest, the natural result is that the contractors retailiate. This means energy spent not in building up the electrical industry, but wasted in competition. Where the contractors maintain prices at too high a level, the development of the industry halts, and the central station quite naturally retaliates by going into the wiring business. This again means energy misapplied in competition."

One of the proposed services of the society will be to co-operate in promoting harmonious local relationships. It is our belief, founded upon the experience of many cities that the bringing together of local interests on a common live-and-let-live basis stimulates the business for all. Prices are fair. Energy and money are not wanted in business warfare, but are used in business development. More houses are wired; more material is used in consequence; more appliances are sold; and more current is sold to operate them.

This harmonizing of local conditions is a delicate work, requiring tact and experience. It seldom can be done by local interests, but the Society of Electrical Development can do it—will do it—in your city if you as a member desire this service.

It will take time but we have the time. It will take money, but we can well afford the money: for the carefully graded subscriptions by which the funds are created for the various work, are a very small proportion of what it will mean to us all to accomplish the purposes of what is probably the greatest and most far-sighted mutual co-operative effort which has ever been developed in any known industry.

Prevention of unfair competition among public utilities in California is sought by a new law effective August 10, 1913, by which it is made unlawful for any person engaged in the distribution or sale of the product or service of any public utility, to discriminate between different sections, communities or cities or portions thereof, by furnishing such service at a lower rate in one section, community or city or any portion thereof, than in another, after making allowance for difference, if any, in the grade, quality or quantity, and for cost differences between such places due to distance from the point of production, manufacture or distribution, and expense of distribution and operation, where such discrimination is made with the intent to destroy the competition of any regularly established dealer in such commodity, product or service, or to prevent the competition of any person, firm, private corporation or municipal or public corporation who or which in good faith intends and attempts to become such dealer. The act is not intended to prohibit the meeting in good faith of a competitive rate, or to prevent a reasonable classification of service by public utilities for the purpose of establishing rates.

JOURNAL OF ELECTRICITY
POWER AND GAS

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E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Pacific Northwest Conventions

September is the month of conventions on the Pacific Coast, particularly in the Northwest, where the Northwest Electric Light & Power Association and the American Institute of Electrical Engineers have held meetings at Seattle and Vancouver respectively, during the past two weeks and the electrical jobbers are yet to meet near Portland. Besides the spirit of harmony and good fellowship created by these get-together meetings and in addition to the value of the papers and discussions particular attention is also called to the many resources of this productive region. Fertile lands, dense forests, productive mines, streams teeming with fish and supplying abundant water for power and irrigation, are of great interest to those whose lands have been longest stripped of these bounties of water.

The water last named because most recently used, is capable of the greatest development and on its wise utilization depends a large measure of the material prosperity of the people. For the irrigation it brings forth latent raw products, as a power source it is turning the wheels of industry. Within little more than a decade the futile roar of the water-fall has been supplanted by the busy hum of the generator and the power waste of many waters harnessed to the needs of man.

The key which has unlocked this great store house of Nature is the enthusiasm of the people. The spirit of zealousness is reflected by the active existence of the Northwest Electric Light & Power Association for the past five years and by the energy of the sections of the American Institute of Electrical Engineers at Vancouver, Seattle, Portland and Spokane. May success attend their efforts!

Flat Rates versus Meter System

Progress is relative. While many central stations are discussing the merits of a sliding scale and maximum demand charge, many more, particularly those among the smaller towns, are still doing business under the old flat-rate system. Notwithstanding the advantages of the meter system, there are still extenuating circumstances that seem to favor the survival of the flat rate.

Foremost among the reasons for the retention of the old method has been the supposed necessity of maintaining the good will of the consumer. But experience shows that with proper education the great majority will admit the justice of a measured rate. Under the most favorable condition great waste of current results from the flat rate system, the consumer getting no benefit from a large proportion of the current he uses. The mere fact that hydroelectric power costs little is a poor argument for wasting it.

The possibility of decreased revenue is another bug-bear which can be overcome by a careful adjustment of rates. Many companies supplying rural com-

munities in the extreme West, make an attractive rate for domestic power and heating, which evens the load curve and satisfies the consumer.

There is more truth than fiction in the phrase, "eventually—why not now." Every year that this step is deferred but adds to the complication when the change is made. Lastly it will be found to create harmony between company and consumer.

Pleasing the Public Profit

The central station, like Caesar's wife, should be beyond suspicion that because they make "light" they can afford to waste it. They frequently overlook economy, although they know that waste is invariably disciplined. To the public such lack of interest is viewed as neglect and it is then that the real trouble starts. Sometimes the upheaval results in compelled improvements, but always, as a consequence of these disagreements, the breach widens between the public and the public service corporation.

Voluntary service improvements satisfy, but compelled improvements are an incentive to complete control—public ownership.

Yet with an eye to economy of operation the wide-awake manager or superintendent may often avoid the occasion for disagreement and so help close the breach. Improved conditions, increased profits, and a more friendly attitude of the patron may all be secured by the exercise of a little forethought.

The present ineffective and wasteful method of street-car lighting illustrates the point. In this case, the patron, or rather passenger, is the chief sufferer, as ocular discomfort and positive eye-strain result from endeavoring to read under the poor lighting conditions which always prevail where lamps not equipped with shades or reflectors are used. The street car company loses financially. That considerable economies result from equipping a lamp with a reflector is well established—that is to say, greater illumination is then secured with a lower consumption of current. Properly installed, these shades or reflectors so improve lighting conditions that eye-ease and comfort in reading result. The eyesight of street car conductors is subjected to an unusual strain as they continually look from the comparatively dark step into the too glaringly brilliant car. It is readily deducible that improved illumination of street cars will contribute towards reducing accidents.

This illustration points to a condition under which the public suffer most, but in the remedying of which the street car company profits most. Better working conditions always insure more contented employes, better service, a more satisfied patron—an improved public opinion— and the increased economy of operation, which experts state will approximate fifty per cent in the majority of cases, results in increased profits.

It is the same to him who wears shoes, as if the whole earth were covered with leather, so surely, Hafiz, the children of the cobbler shall be no longer ill-shod.

Electrical Farming

The industrial application of electricity has been least in the country's greatest industry. Though agriculture produces about forty per cent of the total wealth of the United States much less of its work is done electrically than in either manufacturing or railroading, each of which represents about half as much wealth. If the twenty million horses and mules now used in farm work were displaced by mechanical power one hundred million acres of cultivated land would be released for human requirements. The application of scientific methods to farming, both in cultivation and fertilization of the soil, should double the present production, also lessening the drudgery and the cost.

The high cost of living is largely due to the low efficiency of farm labor as compared to the higher efficiency in other industries whose rapid growth will contiue to make even greater demands upon farm productivity. Much of this waste energy can be conserved by scientific farm management. Power saves wages, the high cost of labor being responsible for the greater part of the expense of farming.

Greater progress has taken place in agriculture within the memory of men now living than in all the ages preceding. It was not until the middle of the nineteenth century that manual labor was superseded by the crudest machine methods. Since then the improvement in farm machinery has been rapid, in spite of the proverbial conservatism of the farmer and the peculiar difficulties to be met in mechanical means. In fact it is only since the development of the automobile that engineers have devised a power plant which can satisfactorily go to the work as contrasted with other industries where the work is brought to the plant. Furthermore the average farm has a low load factor, little power being required in some seasons, while much is necessary in others, especially for plowing. However, this is really a more favorable condition for the machine than for the horse, as a tractor or motor does not eat its head off during the winter months.

While any form of power is good, electrical power is the best to employ where it is available. It is safe, clean, reliable and flexible. It is equally available for field and home. At less than the cost of keeping a team of horses a twenty-acre farmer can get current to irrigate his land, light his buildings and do his chores. By means of the electric telephone he is in close touch with the markets and may be warned of approaching storms or impending frosts. This subject in its entirety is of sufficient importance to warrant more specific discussion in succeeding issues, of which this is to be regarded merely as a general introduction.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

K. G. Dunn, vice-president of Hunt, Mirk & Company, has returned to San Francisco from Southern California.

D. B. Penrose, of the Fobes Supply Company, Portland, and Mrs. Penrose, are spending a vacation week in San Francisco.

S. W. Peterson of H. B. Squires Company, Portland, and wife, are among recent visitors in San Francisco on a vacation trip.

Ray Murphy, manager of the Westinghouse Lamp Company, Los Angeles, has been spending the last week in San Francisco.

Garnett Young, manager of the Telephone Electric Equipment Company, San Francisco, has left for a two weeks' vacation season.

H. H. Hatswell, formerly with Wicks Boiler Company, has recently become connected with Chas. C. Moore & Company's Seattle office.

A. G. Drake, assistant general manager of Woodill & Hulse Electric Company, Los Angeles, spent a portion of the week in San Francisco.

E. B. Walthall, assistant general manager San Joaquin Light & Power Company, Fresno, spent a few days in San Francisco last week.

D. W. Belden, manager of the El Paso branch of the Westinghouse Electric & Manufacturing Company, was a recent visitor in San Francisco.

A. E. Griswold, of the A. G. Manufacturing Company, Seattle, was in San Francisco, the latter part of the week, where he contemplates opening an agency in the near future.

Darrah Corbet, of Chas. C. Moore & Company's Seattle office, has returned from San Francisco where he has been conducting a test on the No. 2 plant of the City Pumping Company.

A. E. Wishon, assistant general manager of the San Joaquin Light & Power Company, Fresno, came to San Francisco for a few days last week to assist in welcoming the arrival of the stork at his home.

H. K. Dutcher of Ducane, Dutcher & Company, Vancouver, B. C., has been retained by the municipality of South Vancouver to investigate and report on the feasibility of a municipal light and power plant.

G. F. Kirkpatrick of the lamp department of the Los Angeles branch of the Pacific States Electric Company, has left for an extended trip East during the course of which he will visit the various lamp manufactories in that section.

G. W. Welsh and **F. E. Geibel**, assistant engineers in the electrical engineers' office of the Southern Pacific Company, at San Francisco, are attending the convention of the American Institute of Electrical Engineers at Vancouver, B. C.

W. L. Goodwin, vice-president and general manager of the Pacific States Electric Company, San Francisco, writes from New York of encouraging business conditions existing at present in the East and bright prospects for the future.

M. C. McKay has resigned as assistant mechanical and electrical engineer of the Panama-Pacific International Exposition to become general superintendent for the Sierra & San Francisco Power Company. He has been succeeded by **L. F. Leury.**

L. A. Sommers, manager of the industrial and power department of the Westinghouse Electric & Manufacturing Company, San Francisco, and family, has left for Southern California and contemplates spending a week's vacation at Catalina Island.

G. F. Richards, C. E., superintendent of construction U. S. Q. M. department at Alcatraz Island, was a visitor in San Francisco during the week in connection with business of the electrical installation now being made by the government at that point.

A. H. Babcock, electrical engineer for the Southern Pacific lines, is attending the Pacific Coast convention of the American Institute of Electrical Engineers, at Vancouver, B. C., where he presented a paper on "The Electrification of Mountain Railways."

Arthur H. Halloran, managing editor of this paper. attended the Pacific Coast convention of the American Institute of Electrical Engineers at Vancouver during the past week, giving an illustrated lecture on the Panama-Pacific International Exposition. He will also attend the Electrical Jobbers' convention at Gearhart.

SEATTLE JOVIAN LEAGUE.

At an enthusiastic rejuvenation held at the Washington Hotel Thursday evening in connection with the Northwest Electric Light & Power Association convention twenty-five candidates were initiated. Following the rejuvenation a buffet luncheon was served, in which the victims and all Jovians present participated heartily. Over one hundred Jovians from the northwest were present and witnessed the initiation of the following candidates:

H. L. Bleecker, Washington Water Power Company, Spokane.

C. R. Young, Pacific Power & Light Company, Portland.

B. P. Bailey, Pacific Power & Light Company, The Dalles, Oregon.

G. J. Drennan, Pacific Power & Light Company, Pomeroy, Wash.

C. C. Turlay, Portland Railway, Light & Power Company, Vancouver, Wash.

W. M. Hamilton, Portland Railway, Light & Power Company, Salem, Ore.

W. E. Herring, Puget Sound Traction, Light & Power Company, Seattle.

F. O. Straight, Puget Sound Traction, Light & Power Company, Seattle.

F. N. Killan, Pacific States Electric Company, Seattle.

C. J. Edwards, Yamhill Electric Company, Newberg, Ore.

A. S. Hall, Hood River Gas & Electric Company, Hood River, Ore.

T. Nickerson, General Electric Company, Seattle.

H. A. Patton, Washington Surveying & Rating Bureau, Seattle.

Harry Byrne, North Coast Electric Company, Seattle.

H. A. Wilson, Seattle.

S. W. Mason, Seattle.

G. E. Hill, Northwestern Supply Company, Seattle.

R. A. Griswold, A. G. Electric & Manufacturing Company, Seattle.

R. J. Cogley, Telephone Electric Equipment Company, Seattle.

J. I. Colwell, Western Electric Company, Seattle.

W. D. Freeman, Seattle.

B. W. Collins, Tacoma.

E. G. Robinson, Jim Creek Water, Light & Power Company, Arlington, Wash.

F. W. Caldwell, Caldwell Machinery Company, Seattle.

P A. Bertrand, Grays Harbor Railway & Light Company, Aberdeen, Wash.

Degree Team.

The Degree Team furnished by Statesman Burton R. Stare of Seattle, did excellent work. The personnel was as follows:

Jupiter—R. W. Clark; Neptune—G. B. Harrington; Pluto—F. M. Kollock Jr.; Vulcan—T. B. Bennett; Mercury—L. W. Jones; Hercules—R. G. Reiniger; Mars—Carl Bush; Apollo—A. A. Miller; Arrenim—A. J. Quigley,

MEETING OF AMERICAN MINE SAFETY ASSOCIATION AT PITTSBURGH, PA.

On September 22, 23, and 24 Pittsburgh will be invaded by prominent mining men, surgeons of mining companies, and the miners connected with the rescue and first-aid work from many parts of the United States. Western Pennsylvania and the Pittsburgh district in particular will be largely represented.

An interesting program of papers and discussions has been prepared, and arrangements have been made to visit points of interest in and about Pittsburgh.

Mr. J. W. Paul of the Bureau of Mines, reports that the arrangements for the mine-rescue contest, which will be held at Arsenal Park on September 22, assures the success of this unusual event.

The Bureau of Mines has arranged a big experimental explosion at their mine at Bruceton. This will be the first explosion exhibit given at the mine since its completion. It is expected to attract unusual attention. There was an experimental explosion in the mine in 1911 on the occasion of the National Mine Safety Demonstration, and another in 1912, but in both cases the mine was as yet only partly opened, and the various electric recording apparatus, and the apparatus for controlling the explosion had not been placed, so that practically all that the mining public could see was an explosion of dust. On September 23, however, it will be possible for those interested in such matters to see just exactly what causes the explosion; how the explosion wave acts; the speed and the pressure and other important items, as these will all be automatically recorded in the instrument room. A number of rescue men fitted with artificial breathing apparatus will enter the mine immediately after the explosion, so as to illustrate how they can go into a mine still smoking and full of gas immediately after a disaster.

INTERNATIONAL ENGINEERING CONGRESS, 1915.

In connection with the Panama-Pacific International Exposition in San Francisco, in 1915, there will be an International Engineering Congress, in which engineers throughout the world, representing all branches of the profession, are invited to participate. The congress is to be conducted under the auspices of the American Society of Civil Engineers, the American Institute Mining Engineers, The American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and The Society of Naval Architects and Marine Engineers.

The organization and conduct of the congress have been placed in the hands of a committee of management consisting of the presidents and secretaries of these five societies, and of eighteen other members representative of them and resident in or near San Francisco.

The honorary officers of the congress will consist of a president and a number of vice-presidents, selected from among the most distinguished engineers of the world. Colonel George W. Goethals, chairman and chief engineer of the Isthmian Canal Commission, has consented to act as honorary president of the congress and is expected to preside in person over its general sessions. The names of the vice-presidents will be announced in the near future.

The congress will hold its sessions during the week, September 20-25, 1915, in San Francisco, in the auditorium and section rooms which will be placed at its disposal by the management of the Panama-Pacific International Exposition Company.

Two distinct, though perhaps equally important, purposes of the congress should be here emphasized. These are:

First: The gathering together of a large and representative body of engineers from all civilized countries, with the opportunities which this will present of forming or renewing personal acquaintances, and of interchanging views on the various phases of professional work.

Second: The reading and discussion of papers before the various sections, and their later publication in such form as to constitute a valuable addition to any engineering library.

In scope and character, it is intended that the congress shall be truly international, and that it shall embrace, in a thorough and comprehensive manner, the various branches of the engineering profession. Eminent engineers throughout the world will be invited to contribute papers on assigned topics, and in the selection and distribution of these topics the committee will use its best endeavors to render the series of resulting papers widely representative of the world's best engineering practice in the various branches of the profession.

As a general rule, it is intended that each paper shall treat its assigned topic in a broad and comprehensive manner and with special reference to the important lines of progress during the past decade, the present most approved practices and the lines of present and future development. It is intended furthermore that all such papers shall be accompanied with a reasonably full bibliography of the subject, giving references to the important original papers and sources of information relating to the special topic of the paper. In this manner the reader will be furnished with a rapid and comprehensive review of the recent important work relating to such topic, together with references to individual papers and sources of information for more complete and minor details.

The committee believes that papers of this type, rather than those which deal with individual constructions or special and individual problems or investigations, will generally serve better the purpose of an engineering congress: that papers of the latter type will naturally find their place in the proceedings of the regular sessions of the various engineering societies, while the occasion of a great engineering congress furnishes a more appropriate opportunity for papers of the broad survey or encyclopedic type.

An important exception to this general plan, however, will be found in a series of papers relating to the Panama Canal and of which it is intended to make a special feature of the congress. These papers will deal with the engineering of the Panama Canal in all its branches, with the influence of the canal on world commerce, commercial trade routes and general transportation problems. Colonel Goethals has promised his aid in securing this series of papers, which will thus form a definite and authoritative discussion of the engineering problems involved in this great undertaking.

The general field of engineering to be covered by the congress has been divided into ten groups or branches, which, together with the special field of the Panama Canal, will constitute eleven divisions or sections, each of which will be presided over by a chairman eminent in the branches of engineering covered by his section.

During the congress each section will hold independent sessions, with such joint and general sessions as may be desirable or suitable having in view the subjects under consideration. The following is a general indication of the sections and the branches of engineering which each will cover:

General Sessions: Official and General Addresses, Discussions on topics of general professional interest. Business Meetings, etc.

1. The Panama Canal
2. Waterways and Irrigation.
3. Railways.
4. Municipal Engineering.
5. Materials of Engineering Construction.
6. Mechanical Engineering.
7. Electrical Engineering.
8. Mining Engineering.
9. Naval Architecture and Marine Engineering.
10. Military Engineering.
11. Miscellaneous.

The activity of the congress in the field of electrical

engineering, assigned to Section VII, will be limited to papers dealing with phases or points of contact and interdependence between electrical engineering and other fields of engineering work. This limitation has been determined by the committee in consequence of the holding of an international congress of electrical engineers in San Francisco immediately preceding the date of the international engineering congress, and by consultation and agreement between the committee of the two congresses.

Publication of Transactions.

It is impossible at this time to determine positively the number of volumes in which the transactions of the congress will be published. So far as it can be arranged, each group of papers, or those covering a specific branch of engineering and presented at any section, will be printed in a separate and appropriate volume.

It is possible, however, that, in order to reduce the expense of publication and keep the total number of volumes within a reasonable limit, it may become necessary to group in one volume papers which may be presented before different sections.

It now seems probable that there will be 10 volumes, six inches by nine inches in size, of about 500 pages each, with one smaller or half volume which will contain the reports of the general or business meeting of the congress, together with a title and author index and a brief digest of each paper presented. One volume will probably be devoted to each section of the congress.

The official language of the congress will be English, and all proceedings and transactions will be published in this language. The papers solicited will be welcomed in any language at the choice of the author; if presented in languages other than English they will be translated, and, together with all papers presented in English, will be printed in this language for presentation at the sessions of the congress.

A special effort will be made to procure discussions, carefully prepared in advance, for presentation with the papers. In addition, opportunity will be afforded for oral discussions at the various sessions of the congress. It is anticipated that limitations of space may require the ultimate publication of all discussions in condensed or summary form. Written discussions will be welcomed in any language at the choice of the writer, and if in other than English will be translated for publication. It is expected that oral discussions will be limited to the English language.

Membership Fee.

The general fee for membership in the congress will be $5.00 U. S. gold, which will entitle the member to receive the index volume and any single volume of the transactions he may select, together with the right of participation in all the general activities and privileges of the congress.

At a later time more detailed information will be furnished regarding the papers to be published in each volume of the transactions, together with a form for further subscription to such volumes as the member may desire. The price of these volumes will not exceed $3.50 for each single volume, which will include delivery within the postal union, and if the total aggregate of subscriptions shall prove sufficient the price will be reduced accordingly. In any case, a reduction will be made in the price per volume in accordance with the number ordered, and a sliding scale of prices will be determined after a more detailed development of the general plan of publication has been worked out.

It is expected that there will be arranged a number of excursions to points of engineering and general interest within practicable reach of San Francisco, and every effort will be made to enable visiting engineers to inspect personally such engineering works as are especially typical of engineering practice on the Pacific Coast.

Further information of general interest and importance regarding the congress will be given publicity through the technical press, and to all subscribers timely notice will be sent containing more complete and detailed information as to papers, sessions of the congress, excursions, itineraries and other matters of importance.

W. A. CATTELL, Secretary. W. F. DURAND, Chairman.

NEWS NOTES OF THE INTERMOUNTAIN COUNTRY.

Statesman Brandenburger is now planning on holding a Rejuvenation October 1st in Salt Lake City.

The Utah Light & Railway Company are having preliminary surveys run for the extending of their Holiday line to the mouth of Big Cottonwood and south to Granite, an extension of approximately ten miles. The road will follow the Wasatch mountains the entire distance. The mountains at this place rise very abruptly from the plain and are one of the scenic beauties of the state.

The Salt Lake and Ogden Railway Company has a large force of trackmen at work on its road bed in Ogden putting down new 85-pound rails and concreting their west tracks.

The Amalgamated Association of Street and Electric Railway Employes of America are holding their 1913 convention at Salt Lake City. The officers of the organization inform us that the progress being made in the present meeting indicates that it will be one of the most successful in the history of the organization. Over five hundred qualified delegates are in attendance at its sessions which are being held in the Hotel Utah.

Oakland, California, and Cleveland, Ohio, are laying plans and doing a great deal of strenuous work to capture the 1915 convention.

Anther striking example of the willingness of public service corporations to assist the cities in which they operate in every way possible has just been strikingly exemplified by the action of the Utah Light and Railway Company in permitting the city of Ogden to tap their large conduit which supplies their Pioneer plant with water. Ogden has had some unpleasant experiences with water shortages during the last year. With this connection to the power company's conduit, which is over six feet in diameter, the city will be practically immune from water shortage.

In one or two instances during the past the city has been confronted with empty mains and the attendant danger of large damage from fire. The Railway Company are permitting the city to tap their conduit and propose to make no charges for the use of this service.

The great carnival of the Intermountain country is over and the Wizard of the Wasatch, having appeared to his wards, has returned to the fastnesses of the Wasatch Mountains. With great electrical parade, which was the most beautiful ever seen in the Intermountain country, the celebration in honor of the giver of happiness and plenty, which has lasted for three short days closed at midnight last Saturday night.

The parade, which was headed by Held's band with the Wizard and his escorts immediately behind was one of the electrical triumphs of the celebration and probably represented the most successful attempt at an illuminated parade ever given in the Intermountain country. Besides the six bands who escorted the parade, there were beautiful floats, the result of the best talent that could be obtained, symbolical of the sun, the moon, earth, fire, grain, metals and mines, flowers and fruit, etc. The Wizards of the canopied float, which was hung with Oriental silk and gold fringed curtains, was probably one of the most beautiful in the parade.

Everything in the parade was brilliantly lighted with electricity, there being hundreds of lights on each float.

NEWS NOTES

ILLUMINATION.

VERNON, CAL.—Sealed bids will be received up to October 7th for a franchise for a pole and wire system along all streets, alleys, etc., in this city.

COMPTON, CAL.—Sealed bids will be received up to October 7th for a franchise, granting right to construct and maintain for a period of 50 years, an electric pole and wire system on all streets and thoroughfares in this city.

MADERA, CAL.—The Madera Gas Company has applied for authority to purchase the gas plant in Madera owned by Geo. W. Kitchen, and to issue $25,000 in stock and $25,000 in bonds for the purpose of taking over the system and extending it.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company is about to increase its electric generating plant in the Potrero district by another 15,000 kw. steam turbo-generator, which is to be furnished by the General Electric Company. The new turbine is of the Curtis type, vertical, and of 18,759 k.v.a. capacity. It is expected that it will be installed and in working order by November 1st.

LOS ANGELES, CAL.—Consumers of gas in this city have been using natural gas from the Midway oil fields for the past three weeks without knowing it. The companies have begun to mix natural gas from the Midway fields with the artificial product in the city mains, starting with about 10 per cent, which will be gradually increased as the gas can be furnished through the main pipe line from Kern county. The intention of the companies to supply Los Angeles with natural gas wholly has not been realized yet, for the reason that the pressure on the line is not sufficient to carry any great supply over the 125 miles of main from the Midway fields to the city limits. At the present time $750,000 is being spent in the construction of pressure stations along the line that will serve Los Angeles with a possible load of 26,000,000 ft. per day.

TRANSMISSION.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors of Los Angeles county up to October 6th, for sale of an electric transmission line and distributing system upon and along certain public highways in Los Angeles county.

RANDSBURG, CAL.—A long term contract has been entered into between the Yellow Aster Mine & Milling Company and the Southern Sierra Power Company, whereby the latter agrees to furnish the Yellow Aster mine with electric power sufficient to operate mills and various pumping plants. The contract includes the construction of power transmission lines from Randsburg substation of the power company, surveys for which have already been made.

WOODLAND, CAL.—The petition to restrain the Yolo Water & Power Company from constructing the $90,000 dam at Clear Lake, Lake county, was not granted by the Lake County Board of Supervisors. The petition stated the dam would interfere with the natural conditions of Clear Lake. Roy M. Pike, president of the Yolo Water & Power Company, guaranteed that no such condition would result and building operations were renewed.

LOS ANGELES, CAL.—The stockholders of the San Joaquin Light & Power Company, at a recent meeting held in Los Angeles, ratified the issuance of $1,375,000 two-year six-per-cent collateral trust notes, dated August 1 and optional at 101, with interest quarterly. The full board of directors was present at the meeting. The outstanding bonds issued and assumed of the company amount to $3,156,000. The S. J. L. & P. Corporation, the new company, has outstanding $4,256,000, making a total of $7,412,000. The authorized bonded debt is $25,000,000. It is reported that a part of the authorized but unissued first and refunding bonds of the corporation will be deposited with a trustee as security for the note issue. The outstanding funded debt of the company will be $9,287,000 when the notes are issued. In addition to fixed charges the company has been earning and paying 6 per cent on $6,500,000 cumulative preferred stock with a surplus equal to 1 per cent on $11,000,000 outstanding common stock.

SAN FRANCISCO, CAL.—Commissioner Thelen heard the application of the Great Western Power Company for a modification of the terms of a recent order of the commission apportioning the expenditure of the proceeds of a recent bond issue. Counsel explained that the company desired to abandon the construction of extensions in certain districts and to substitute therefor, additional expenditures elsewhere. The chief items in its plan of new construction, which it is sought to eliminate are as follows: $20,000 for Sacramento substation; $75,587 for extensions in North Sacramento; $7175 for a line to Sebastopol; $8056 for distributing system in Sebastopol; $10,169 for lines in suburbs of Sebastopol, $104,-800 for Dixon installation, and $25,745 for line from Bologna to Richmond. The total of the abandoned service will be about $251,000. The reason given for the abandonment of the Sacramento, Sebastopol and Dixon development was the active competition of other companies furnishing an adequate service at a fair price. Richmond, he said, would be more cheaply served by a tie-line along the bay shore. The commissioner took the matter under advisement.

TRANSPORTATION.

SAN RAFAEL, CAL.—S. J. Norton has been granted a franchise to operate a street railroad upon certain designated streets in the city of San Rafael.

RED LODGE, MONT.—The proposed route for an electric line from Red Lodge to the Washoe and Bear Creek coal mining camps, has been surveyed. The cost of construction has been estimated at $49,597.30.

SAN FRANCISCO, CAL.—The Clear Lake Railroad Company has filed an amended application with the commission asking for authority to issue $500,000 in bonds and $20,000 in stock for the construction and equipment of a railroad from Hopland to Lakeport. The original application was filed a month ago.

PORTLAND, ORE.—The first grading camp on the right of way of the new electric line between Milwaukee and Gladstone, which will form a connection with the Clackamas Southern, has been established about four miles from Milwaukee near Webb Acres. R. L. Ringer is the contractor in charge. The line will cost in the neighborhood of $20,000 a mile.

RIVERSIDE, CAL.—The supervisors have denied the petition of the Pacific Electric Company for a deeded franchise on lower Magnolia avenue on the grounds that the deed of 50 ft. in the center of Magnolia avenue would give the trolley company control of the center line of trees on an avenue, which it is sought to preserve. The supervisors have signified their willingness to grant an ordinary franchise over this route.

FRESNO, CAL.—The commission has issued an order allowing the Fresno, Hanford & Summit Lake Interurban Railway Company to issue $358,000 six-per-cent bonds and sell them at 80, the proceeds to be used in building the first unit

of the road from Fresno to Selma. This order is qualified by a proviso that J. H. Summers, the custodian of $1,250,000, par value of the road's capital stock shall not sell any of it until the first unit is completed.

VISALIA, CAL.—The Big Four electric railroad has applied to the city trustee for a franchise, stating that it intends to extend a line to Fresno, taking in Lindsay and other way points. The officials of the road ask for a single and double track in Visalia going through one of the principal streets, granting concessions in the way of property to the city if the trustees will grant the franchise. The matter was given its first reading. As the ties are being received daily from San Francisco for the work on the line, crews of men are being rushed here so as to put the line through as rapidly as possible without loss of any time.

SAN FRANCISCO, CAL.—Positive assurance was given by T. W. Ransom of the city engineer's office to the public utilities committee of the supervisors that the municipal railways to be built with the new bond issue would be finished and ready for operation by January 1, 1915, with the exception of the tunnel portion of the Church street line, and that plans for the various lines would be completed by December 1 next, and that contracts would be let by January 1 next for materials, cars and a new carhouse sufficiently large to accommodate 100 cars. The car barn of the Geary street road houses 60 cars. New plans for cars will be furnished by the city engineer's office.

SAN FRANCISCO, CAL.—The commission has directed the San Jose Railways to reconstruct as a standard gauge line its present narrow gauge system from San Jose to Toyon station on the road to Alum Rock Park, a distance of 4½ miles. The company is further directed to make a connection at Toyon station with the Peninsular Railway, which will make a continuous line from San Jose by way of Linda Vista and Toyon stations to Alum Rock Park. The San Jose Railways is given one year in which to complete the standard gauge road and make connection. The commission finds that public convenience and necessity require the reconstruction of the San Jose Railways line from San Jose to Toyon station as a standard gauge road and a connection at Toyon with the Peninsular Railway which will restore a through direct service to Alum Rock Park. It is estimated that the reconstruction and extension of the San Jose Railways will entail an expenditure of approximately $80,000. Under the terms of the decision the San Jose Railways must within six months, reconstruct its road from San Jose to Linda Vista station, and within six months thereafter from Linda Vista to Toyon. The company is given authority to remove the remnant of its old line from Toyon to Alum Rock Park.

TELEPHONE AND TELEGRAPH.

TOLEDO, WASH.—The Lewis county commissioners have granted a franchise to the Rainy Valley Telephone Company for the erection and maintenance of a telephone line along the county road from Fulton ferry to Randle. At the same time they granted to the Hanford-Skookum Telephone Company a franchise for the erection of a telephone line from the north line of the county to the city limits of Centralia and up the valley of the Hanaford.

DUNCAN, ARIZ.—John Evans has been appointed receiver of the Duncan Telephone Company. J. E. Collis, former manager, has retired and Mr. Moshier has been appointed manager. The company expects to repair the lines and put the service in first class shape, active operations having been started towards that end. Receiver Evans is corresponding with the Mountain States Telephone Company with a view to re-establishing long distance service.

SAN FRANCISCO, CAL.—At a recent meeting of the supervisors the resolution recommended by the public utilities committee directing the city attorney to confer with the Pacific Telephone Company in regard to the suggestion that the company agree to conduct its business hereafter under the terms of the Home Company's franchise, paying thereunder 2 per cent of its gross revenue to the city on condition that the city cease its attempts to set aside the merger, was adopted. The same action was taken on the resolution asking the city attorney's opinion as to the validity of the Pacific Company's present franchise.

SAN FRANCISCO, CAL.—The Sunset Telephone & Telegraph Company, one of the subsidiaries of the Pacific Telephone & Telegraph Company, has called for payment October 1st its $2,250,000 consolidated mortgage 5 per cent bonds. The redemption is 105, so that the amount involved will be $2,362,500. On July 1st $750,000 first 6s matured and were paid off, which leave the Sunset Company without bonded debt. To provide for taking up these two subsidiary issues, $3,000,000 of the $35,000,000 Pacific Telephone first and collateral trust 5 per cent bond issue was reserved. The bonds now called do not mature until 1929, but are callable beginning October 1st. The sale of $3,000,000 Pacific Telephone first 5s, will close the issue at $35,000,000 in addition to which there is outstanding $7,080,000 Home Long Distance Telephone Company first 5s.

WATERWORKS.

WATERVILLE, WASH.—The contract was given to John Mohr to construct a ditch and lay 5200 ft. of water mains.

PENDLETON, ORE.—Thirteen bids ranging from $160,000 to $220,000 for the construction of the gravity water system, including the pipe line and reservoirs were received.

SANTA YNEZ, CAL.—Three wells have been completed for the Solvang Water & Irrigation Company and that company is going ahead with its work of connecting its pump and laying pipes to the town of Solvang.

OXNARD, CAL.—By the terms of agreement and proposition submitted by the Ventura County Power Company, through its manager, W. F. Hunter, the old water system and plant was informally transferred to the city of Oxnard on September 1st.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company has finally agreed to accept the price offered by the city for the present water system, $142,500. A new special election will be held soon for the people to vote on the proposition.

OXNARD, CAL.—At time for opening ibds for street lighting bonds, proceeds which were to be used to purchase the water plant of the Ventura County Power Company, no bids were received. The bonds will be sold at private sale to the power company.

LA CROSSE, WASH.—The La Crosse waterworks system is to be improved, new mains are to be laid on the west side of the track and a new line will be built to the school line to replace the wooden mains. The pipe will be large enough to supply four times the amount which has been furnished to the residents of this district.

LOS ANGELES, CAL.—The city council has authorized advertisement for bids for the purchase of the Mojave-Proctor pipe line and lands connected therewith. This includes 400 acres of desert land, and 102 acres of land along the pipe line, on which water has been developed. The minimum price of $22,400 has been set on the land and plant.

ASTORIA, ORE.—Warrenton citizens have decided not to float the $100,000 proposed bond issue. A motion was carried calling on the city council to lay aside $500 for immediate use of the water commission in investigating and devising plans for a water system. They will investigate the sources of supply, and if necessary a special tax can be voted for the furtherance of the work.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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Journal of Electricity
POWER AND GAS
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LOGGING BY ELECTRICITY[1]

BY E. J. BARRY.

In October of last year the Potlatch Lumber Company, of Elk River, Idaho, placed in service two electric logging engines, and from the results obtained it is confidently anticipated that these will prove the forerunners of many similar installations in all countries where logging operations are carried on. Recently the writer was able to make a test on these machines, and the results are given in the hope that they may be of interest to engineers in general.

11000-550 Volt Transformer Car with Flexible Armored Triple Conductor Cable to Hoisting Machine. Cable Shown at Rear of Car.

The logging engines were especially designed and built for electric drive, for use with what is known as the McFarlane skyline system. The McFarlane system is especially adapted for use in country where the logs have to be removed from steep hillsides. A 1½-in. steel cable is anchored to standing timber on the crest of the hill, the other end being fastened to the hoisting drum of the donkey. This cable may be carried out a distance of 4000 ft. under favorable conditions; that is to say, where the weight of the trailing logs will not cause too great a sag.

A carrier or trolley attached to an endless line brings in the logs, clearing the entire hillside within the limits of its travel.

When one portion has been cleared the main cable is moved to a new location, and so on until a radius of from 3000 to 4000 ft. has been cleared of timber. The logging engine may remain in one place for two

Log Carrier.

[1]Paper presented at the 285th Meeting of the American Institute of Electrical Engineers, Vancouver, B. C., September 9-11, 1913.

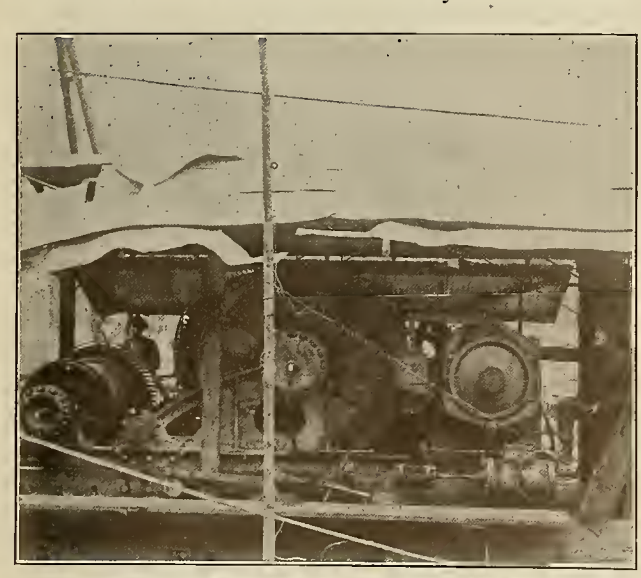
or three weeks, and thus save the expense of moving continually, which the older method of ground haulage involves. Also the logs are in much better condition for the sawmill when they have not been hauled bodily over the gravel and rocks. Pieces of gravel in the

11000-550 Volt Transformer Car.

latter case are embedded in the bark with disastrous results to the saws when they come in contact with them.

The skyline method permits of much faster handling, as the logs, having only one end trailing, are not likely to encounter obstacles.

The electrical equipment of each machine consists of one 150-h.p., 550-volt, 600-r.p.m., 60-cycle, 3-phase wound-secondary logging type motor, equipped with a solenoid brake. The motor is totally enclosed and of



Drums and 150 Horsepower Variable Speed Motor With Solenoid Brake.

very substantial construction to withstand the exceedingly hard service the work involves. The control consists of a seven-point controller connected to a bank of resistance grids located in the rear of the skids on which the machine is mounted. The controller also operates the primary circuit, making the drive self-contained.

As a safeguard a time element oil circuit-breaker switch is also installed, together with an ammeter

Starting to Haul In.

mounted in view of the operator, who is thus able to determine the safe stresses he can place on the steel cable. In practice it has been found that the cable is the weak link in the chain, the motor being able to take care of any and every load applied so far.

The brakes are operated by air from a compressor driven by a 7½-h.p. motor. Compressed air also operates the signal whistle, an important feature of logging equipments, as in most cases of long haulage the operator cannot see the load on starting, but must depend on signals, given by the hook tender, as to what he has to do.

Power is transmitted at 11,000 volts from the sawmill power plant located 3½ miles from the present logging operations. Portable substations mounted on flat cars, as shown in the illustration, step the voltage down to 600. Power is then supplied to the motors by triple-conductor No. 000 cable, steel armored, and lead covered. Expulsion fuses and horn-gap arresters protect the primary side of the 200-kw. 3-phase oil-cooled transformers.

The line construction has been made as simple as is compatible with safety, and inclusive of all charges, clearing right of way, material and labor, but cost of land not included, amounted to $767 per mile.

The illustrations show the general contour of the country in which these operations are being carried on, and also why it is unnecessary to make frequent changes of location for the logging engine.

The average daily haul for the month of April this year was 33,000 ft. for No. 1 donkey; an excellent showing, everything considered. On May 13th the machine under test brought in 55,000 ft. of logs, establishing a record. When certain mechanical defects in the equipment have been rectified it is expected that this record will be exceeded.

The rate of travel of the trolley at present is 1000 ft. per minute, hauling in an average load of

1700 log ft. It is expected to increase this rate of travel to 1200 ft. per minute on the new carrier shortly to be placed in operation.

It is to be remembered that the white pine logs in this district are small compared to the fir and cedar of the Coast timber, where the distances hauled would have to be shortened considerably.

For the test a curve-drawing wattmeter was used with an indicating wattmeter as check; an ammeter and a voltmeter were used to check power factor.

Running out light, the carrier showed an average power input of 63 kw.

Hauling in logs scaling 1000 to 1500 ft. showed an average power input of 104.1 kw.

Loading logs on cars averaged an input of 80 kw. Power factor equaled 68 per cent, average.

Interior of Car During Tests.

A decided saving in time and power consumption would be effected by using a separate mortor and light hoisting apparatus for loading and so permit loading and handling at the same time. At present the one hoist has to do duty for both operations, for which it is not suited. A 50-h.p. motor would have ample capacity for loading logs either on rollways or cars.

The advantages of electric over steam haulage can be summed up briefly:

No fuel required, with consequent wastage of good lumber, averaging about 1000 ft. per day for each engine.

Elimination of fire risk in the forest.

Lower labor costs; no firemen or wood cutters required to supply fuel.

No freezing of boiler tubes in winter and consequently no charge for night watchman in cold weather.

Maintenance costs less than with steam; boilers have to be washed every two weeks and engines with reciprocating parts are harder on upkeep.

No water required. This is often a serious item, it being necessary in many cases to pump water for a distance of two miles.

No delays to get up steam and no shutdowns through failure of pressure, a frequent happening on long hauls.

No danger of boiler explosion.

Greater adaptability in regard to speeds, which can be increased beyond standard engine speeds at present in use.

The output of each machine can be standardized readily.

The output of steam donkeys will vary in ratio to the attention paid to proper firing.

It is estimated that a saving of at least 50 cents per thousand would be effected.

During 1911 the St. Paul & Tacoma Lumber Company, between contracts and camps hauled 81,000,000 ft., log scale. On combined operations the gross saving would be $40,500, from which the cost of energy would have to be deducted. Our records on the Potlatch test average 10 kw.-hr. for each 1000 ft. logged. This varies somewhat, but is sufficient for practical purposes.

This 810,000 kw.-hr. per year at the rate of 1.5 cents equals $12,150; and $40,500, minus $12,150, equals $28,350 saving effected, even at a minimum of 50 cents per thousand. The saving in elimination of one of the gravest fire risks can hardly be estimated in dollars and cents, but would pay a heavy interest, without any doubt.

The Smith Powers Co., of Marshfield, Ore., will have its electric logging engines in operation this summer, when data dealing with Coast timber will be available.

The development of logging by electricity will provide a valuable load from the central station point of view, especially on the Pacific Coast, where transmission lines from hydroelectric plants pass through extensive logging areas. Naturally it is an off-peak load and is continuous enough to be well worth trying to secure.

Thanks are due to Mr. A. W. Laird, general manager of the Potlatch Lumber Company, for the courtesy and assistance rendered in making the test.

High-Power Telescopes in Fire-Lookout Work have been found by forest officers to be not always satisfactory. In some localities heat vibrations in the atmosphere are so magnified by the glass that clearer vision can be had with the unaided eye.

At the National Conservation Congress to be held in Washington, November 18-20, the subject of forestry will be handled by a main committee, with subcommittees, which will report on federal and state forest policies, forest taxation, fires, lumbering, planting, utilization, forest schools and scientific forest investigations.

MOUNTAIN RAILWAY ELECTRIFICATION.[1]

A Study of the Tehachapi Pass.

BL ALLEN H. BABCOCK.

During the past ten years the Southern Pacific Company has investigated the question of electrification of its three outlets from the central valleys of California, north, over the Siskiyou, east, over the Sierra, and south, over the Tehachapi. The earlier reports, inspired directly or indirectly by manufacturers as a part of their propaganda program, were favorable to electrification. The railway company then began studies of the subject, independently. The conclusions of its officers were unanimously opposed to electrification, by reason of the financial results to be anticipated; however, some of its lines have been electrified, and other electric lines have been acquired for good reasons.

Lately there has been a constant and persistent pressure put upon the company officials, by both power companies and consulting engineers, to reconsider decisions adverse to electrification, decisions that were made after patient and thorough study, and in the face of the fact that to be connected with any such important engineering work as these installations would be, could but fire the professional imagination of any engineer worthy of the name. Just how much of this agitation has been due to the application of general statements regarding the benefits to be secured by electrification, to the particular problems presented by west coast mountain railroading, is hardly susceptible of direct determination. It is possible, however, that much of it is due to the effect that such hypothetical studies and papers as have been published recently, have produced upon executives, who, however skilled they may be in their specialties, only in rare instances are sufficiently experienced technically to be capable of forming independent opinions on engineering matters. It is a fact that reports adverse to electrification in the hands of these same executives, often cause disappointment and sometimes arouse criticism.

Here, then, are two opposing parties; the one with things to sell, (apparatus, power, engineering skill), the other with a service to be maintained, at decreased cost if possible, but maintained at any cost it must be: the first reports favorably upon projects that the second considers unfavorably with equal positiveness. Some things must be unknown to both. Either the radicals have not all the facts upon which to work, or the conservatives cannot interpret their facts correctly.

Words have been multiplied with reference to the subject until aspiring authors well may pause before adding fuel, not to say fat to the fire; but it is with these thoughts in mind this paper is written, not with the intent to offer anything original in the study of such problems but to give the facts of a typical west coast mountain railroad district and their interpretation as seen by one whose reports heretofore have been responsible for many adverse decisions in such matters.

[1]Paper presented at the 285th meeting of the American Institute of Electrical Engineers, Vancouver, B. C., September 9-11, 1913.

It is not intended to be the final word on the subject of electrification of this district, but it is the result of a study recently made to determine whether there was such a reasonable chance for profitable electrification as would warrant a very considerable expense in time and money, such as was incurred a few years ago in an exhaustive and final study of the Sierra problem, for example.

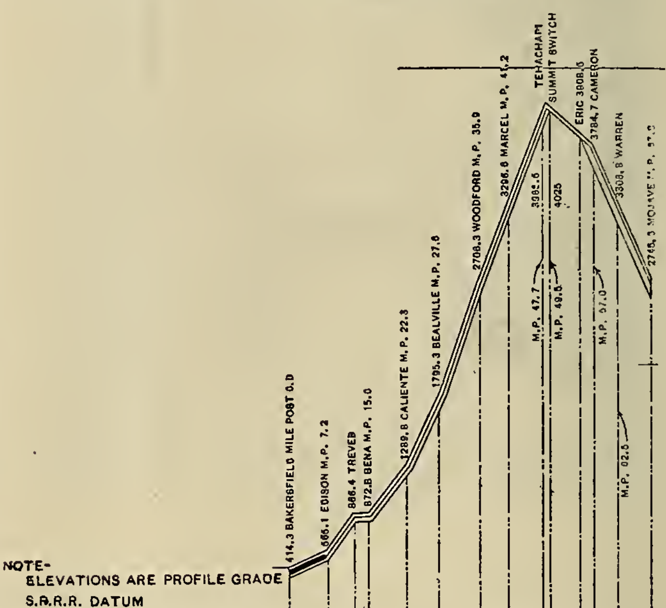
If through the facts given herein, and in the discussion thereof, a better mutual understanding will be reached, its purposes will have been served.

Physical Characteristics.

West Slope, Bakersfield to Summit .... 49½ miles
- Vertical rise .... 3764 ft.
- Average grade .... 1.44 per cent
- Average curvature equal to a constant 3 deg. curve.
- Total curvature, 7944 deg., of which 6969 deg. are between Caliente and Summit (27.2 mi.). The loop curve has a total curvature of 566 deg. 33 min. 12 sec.

East Slope, Mojave to Summit .... 18.3 miles
- Vertical rise .... 1285 ft.
- Average grade .... 1.33 per cent
- Average curvature (as above) .... 0.79 deg.
- Total curvature .... 765 deg.

The ruling grade on each slope is 2.2 per cent, but these grades are not compensated for curvature so that in effect the ruling grade is 2.4 per cent. The maximum grades are long enough to fix the weight and power of the locomotives. The average distance between sidings is three miles, approximately.



MAXIMUM GRADE (FEET PER MILE)		105.6	116.16	116.16
CURVED LINE (MILES)	FROM 0° TO 6° INCL.	11.34		6.44
	" 6°01 " 8° "	2.38		
	" 8°01 " 10° "	7.67	2.63 OF 10°01 & OVER	
TOTAL ASCENTS EAST (FEET)		3686.885		5.5
" " WEST (")		76.885		1285.03
TOTAL CURVATURE		7944°		76.5

Fig. 1. Condensed Profile, Tehachapi Pass.

In determining energy consumption of trains moving over the mountain the actual characteristics of the line were used, but in determining load diagrams and substation spacings and capacity, the following close approximations were made to take care of the ruling grade, curves, etc.

Section.	Miles.	Average grade
Bakersfield to Edison	7.2	0.5 per cent
Edison to Caliente	15.1	1.5 per cent
Caliente to Summit	27.2	2.4 per cent
Mojave to Cameron	10.8	2.4 per cent
Cameron to Summit	7.5	0.75 per cent

The average freight train, eastbound, weighs 2000 tons, exclusive of locomotives. Four consolidation type locomotives, or their equivalent in Mallet compounds, are used to haul this train from Bakersfield to Summit. From Summit to Mojave one locomotive is used for supplying air for brake purposes, etc., and the other three return deadhead to Bakersefield. The westbound freight trains are lighter than the eastbound on account of the fact that much of the western movement consists of empty cars. The normal weight is 1250 tons, hauled by three consolidation locomotives, or their equivalent Mallets; or a 1500 ton train operated by three consolidation or decapod locomotives, or their equivalent in Mallets. The helper engines cut out at Summit and return light to Mojave.

In order to provide a flexible unit it was proposed to use an electric locomotive, capable of handling a train unit of 500 tons, as many per train to be used as the weight of the train requires. The weight of the electric locomotives is assumed at 100 tons.

Passenger train weights vary from 250 tons to 600 tons, for which a single passenger locomotive weighing 150 tons was provided. A maximum freight train movement over the mountain recently consisted of twelve full-size freight trains, eastbound, and eight full-size freight trains, westbound, in addition to the normal passenger movement, which is seven regular trains each way per day, with occasional extras and second sections.

The track, particularly on the west slope, is laid for the greater part of the distance in rough country, in fact between mile posts 326 and 361 all the track, with the exception of a short stretch near Caliente, is in cuts or on fills. It may be said generally that at least half the track is laid in conditions where any overhead contact system would require necessarily, very expensive steel pole or bridge construction. In addition to the above, there are 18 tunnels, in one of which the vertical clearance is more than 18½ ft., and 60 per cent of their total length is on 10 deg. curves.

Experience with similar earlier reports has shown that, in general, there is little difference in total first cost and annual operating costs, whether an overhead system or the third rail system be considered. A double overhead contact system gives maximum first cost and operating costs for contact system, and minimum weights, costs and maintenance of locomotives; a single overhead contact system gives high first cost and operating costs for contact system, with maximum weights and maintenance of locomotives; the third rail gives high first cost and minimum operating cost of contact system, medium locomotive weights and first costs, with minimum operating costs, but the total costs are brought up to the level of the others by reason of the necessary substation apparatus and attendance. A choice of systems therefore is to be made only after an exhaustive study of all the local conditions.

In a preliminary study, as this is, it matters little what particular system of propulsion is chosen upon which to base the estimates. For the purposes of this discussion a 2400-volt continuous current, third-rail contact system was selected for the main line, with an overhead contact system in yards and terminals, at Kern, Bakersfield and Mojave.

In the following the first costs are based on the present traffic as shown by the train dispatcher's sheets; the annual operating costs are taken from the reports of the fiscal year ending June 30, 1912, for steam operation, while the same traffic and reports are used, as far as they apply, in estimating the costs for electric operation.

First Costs.

Substations	$1,610,000
Generating station	1,760,000
Transmission system	430,050
Contact system (yards)	155,250
Contact system (line)	825,000
Bonding	122,300
Block signals	175,000
Shops and inspection shed	10,000
Electric locomotives	2,085,000
Total	$7,172,600
Credit by steam locomotives released for service on other divisions	1,464,900
Net first cost	$5,707,700

Annual Operating Costs.

(Steam-generated power)	Steam.	Electric.
Substation labor and supplies		$ 59,700
Power house labor and supplies		84,780
Transmission and contact system maintenance		36,576
Maintenance of way as affected by locomotives	$126,890	83,285
Locomotive repairs	270,990	70,701
Locomotive enginemen, (passenger)	48,300	29,100
Fuel	240,852	100,530
	$687,032	$464,672
Bond interest at 4½ per cent		256,847
Totals	$687,032	$721,519

Net loss, $34,487.

In the above no account is taken of items not affected by character of motive power: freight enginemen, and all train crew wages, repairs to cars and maintenance of way as affected by cars—for example.

The net loss under proposed electric operation is so small that it might be wiped out by a reasonably small change in the assumptions; in fact, at this stage of similar investigations often there is a temptation to search for opportunities to change this, or to modify that, as the necessities of the case demand. This important fact should be borne in mind, however, that in the foregoing no account is taken of taxes and depreciation, both of which must be paid, some time, by some one, to the extent of at least 5 per cent of the net investment, which increases the net loss by approximately $285,000 per year.

It may be asked why is depreciation not taken into account in the usual manner? The answer is, since there is a loss, or at least no profit shown, and since to add depreciation would be to make a bad matter only worse, nothing is to be gained by entering into the academic discussions that inevitably follow the opening of a subject concerning which opinions reasonably may differ as widely as on this much disputed particular.

But power may be purchased, as is often suggested by those with power for sale; hence it is proper

to determine at what rate this power may be purchased and come out even as compared with operation by steam-generated power. Obviously any rate less than this will be profitable.

With purchased power, the total investment will be diminished by the costs of 20 miles of transmission line and of the generating station, it being assumed that power will be delivered at some one point on the right-of-way, whereas local conditions located the steam station 20 miles off the right-of-way.

The net first cost was		$5,707,700
Transmission line	$ 120,000	
Generating station	1,760,000	1,880,000
Leaving a net investment with power purchased		$3,827,700

Annual Operating Costs.

(Power purchased)	Steam.	Electric.
Substation labor and supplies		$ 59,700
Transmission and contact systems maintenance		35,576
Maintenance of way as affected by locomotives	$126,890	83,285
Locomotive repairs	270,990	70,701
Locomotive enginemen, (passenger)	48,300	29,100
Fuel	240,852	
	$687,032	$278,362
Bond interest at 4½ per cent		172,247
Totals	$687,032	$450,609

The difference, $236,423, should be decreased by $191,385 (the approximate tax and depreciation rate of 5 per cent on the net investment of $3,827,700); and there is left the wholly inadequate sum of $45,038 with which to purchase 53,000,000 kw-hr. at a load factor of about 20 per cent, with no profit to show for an investment of nearly $4,000,000.

For the sake of the argument, let the depreciation be neglected and let it be considered that $236,423 are available for the purchase of power under the operating conditions of the service. At any time there may be four passenger and four freight trains pulling uphill simultaneously, taking a total of 32,720 kw. alternating-current input to the line. This is not the maximum number of trains that is on the mountain regularly, but represents only those taking power. A slight derangement of schedules, or an extra freight movement, citrus fruits or oil, or a blockade, for example, will cause congestion beyond any possibility of estimating. This traffic must be handled as circumstances require. It cannot be spaced conveniently for power demands, as many engineers and power men have suggested, but the terminal yards must be cleared as the cars accumulate. Is there any power company in the west coast country, or even beyond the reach of such a natural power source as Niagara, that would care to undertake such a load for any such yearly return as that named in this paragraph? It would net about 4½ mills, a rate that neither the purchaser nor the seller could afford to consider.

In the face of the foregoing it is difficult to see how any recommendation in favor of electrification can be made, if the opinion is based on the direct financial profit to be realized; in other words, this case is merely another example of the fact often noted that in the great majority of cases the profits from electrification must be realized indirectly rather than directly—increased track capacity, postponing second or double-tracking, or the like.

It may be urged that a larger district would make a better showing. In this connection it may be noted that the line from Bakersfield to Summit is almost identical with half of the line assumed in Mr. Hobart's paper on "2400-Volt Railway Electrification." On each side of the summit Mr. Hobart's assumed line is 3800 ft. rise in 48 miles, with the ruling grade of 2.2 per cent, while the west slope of the Tehachapi is 49½ miles, rise of 3764 ft. and a ruling grade of 2.4 per cent. Also Mr. Hobart assumes freight train weight on heavy days of 1800 tons, as against 2000 tons on the Tehachapi. Furthermore, the Sierra study covered a district more than double the length of the Tehachapi, and the result was the same.

HYDRAULICS—IV.

BY OTTO B. GOLDMAN.

Special Cases and the General Equations for Internal Power Loss.

In the second article we found by equation (34) that the loss due to internal friction

$$L = \phi\theta^2 (s_2^2 - s_1^2) \text{ per unit of depth.}$$

Let us now extend this case to that of the standard elbow, that is one of constant radius of curvature with fixed center and circular cross-section. For a depth dx we have

$$dL = \phi\theta^2 (s_2^2 - s_1^2)\, dx \qquad (36)$$

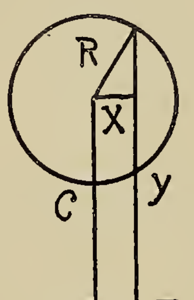


Fig. 3.

In Fig. 3, let R be the radius of the section, and c the mean radius of curvature. For simplicity let us put

$$s_2 = y.$$

$$\text{Then } s_1 = y - 2(y - c)$$
$$= 2c - y$$

We have also

$$(y - c)^2 + x^2 = R^2 \qquad (37)$$

Substituting in eq, (36), we get

$$dL = 4c\phi\theta^2 (y - c)\, dx \qquad (38)$$

But by eq (37)

$$(y - c) = \sqrt{R^2 - x^2}$$

Whence

$$dL = 4c\phi\theta^2 \sqrt{R^2 - x^2}\, dx \qquad (39)$$

Which by integration gives

$$L = 4c\phi\theta^2 \left[\frac{x}{2} \sqrt{c^2 - x^2} + \frac{c_2}{2} \sin^{-1} \frac{x}{2} \right]_{-R}^{+R}$$

and putting in the limits we get

$$L = 4c\phi\theta^2 \left[R\sqrt{c^2 - R^2} + c^2 \sin^{-1}\frac{R}{2} \right] \quad \ldots\ldots\ldots (40)$$

Equation (40) is the general equation of the loss in an elbow, due to internal friction. If the bend is 90 degrees, then θ becomes $\frac{\pi}{2}$. An examination of this equation, shows that the loss tends to increase, with the increase of the radius of curvature. The reason for this is that the loss depends not only on the slippage, but also upon the areas involved. Where the limit is beyond which we should not increase the radius of curvature of a bend, can only be determined experimentally. However, it is interesting to note that the principal loss in a bend is due to internal friction, a matter that has apparently been entirely overlooked. We will have to take up this proposition further, when we take up the subject of the interrelation of the external and internal friction. This subject has important applications in hydraulic design.

We will take up next, the general equations of the slippage and internal friction loss.

By equation (22) we have for the radius of curvature

$$p = \frac{v^2}{\dfrac{d^2s}{dt^2}}$$

Substituting for $\frac{d^2s}{dt^2}$, its value as given in eq (26), we get

$$p = \frac{v^2}{K^2Q_0^2} \; \frac{s^3\left[f^1\left(\frac{s}{k}\right)\right]^3}{sf^1\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \quad \ldots\ldots\ldots\ldots\ldots (41)$$

In passing from one streamline to the adjacent, we have K for the variable, whence we have under these conditions

$$dp = \frac{v^2}{K^2Q_0^2} \, Dk \; \frac{s^8\left[f^1\left(\frac{s}{k}\right)\right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \; dk \quad \ldots (42)$$

For the slippage, we have

$$d^2Z = dp\,d\theta \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (43)$$

Where $d\theta$ is the angle subtended by the arc dr, whence

$$d^2Z = \frac{dp\,dr}{p} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (44)$$

Substituting for p and dp its values as given above, and for dr its value $f^1\left(\frac{s}{k}\right)$ ds, we get

$$d^2Z = \frac{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)}{s^3\left[f^1\left(\frac{s}{k}\right)\right]^2} \; Dk\left\{ \frac{s^3\left[f^1\left(\frac{s}{k}\right)\right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \right\} dk\,ds$$

Whence by integration we get for the slippage

$$Z = \int\!\!\int \frac{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)}{s^3\left[f^1\left(\frac{s}{k}\right)\right]^2} \; Dk\left\{ \frac{s^3\left[f^1\left(\frac{s}{k}\right)\right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \right\} dk\,ds \quad \ldots\ldots\ldots\ldots (45)$$

The areas in contact per unit depth are equal to dr, whence the loss is

$$L = \int\!\!\int\!\!\int \phi \, \frac{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)}{s^3 \; f^1\left(\frac{s}{k}\right)} \; Dk\left\{ \frac{s^3\left[f^1\left(\frac{s}{k}\right)\right]^3}{sf^{11}\left(\frac{s}{k}\right) + f^1\left(\frac{s}{k}\right)} \right\} dk\,ds\,ds \quad \ldots\ldots\ldots\ldots 46)$$

thus obtained in eq (54) the general equation for slippage and in equation (55) the general equation of the resultant power loss.

We are using in all these calculations, curvilinear co-ordinates, because they are natural co-ordinates for the physical conditions involved. They therefore give simpler results and these are more easily interpreted. They can readily be transformed into rectilinear co-ordinates by the following transformations:

$$x = \int \frac{ds}{\sqrt{1 + [f^1(\frac{s}{k})]^2}} \quad \ldots\ldots (47)$$

$$y = \int \frac{f^1(\frac{s}{k})\, ds}{\sqrt{1 + [f^1(\frac{s}{k})]^2}} \quad \ldots\ldots (48)$$

Thus if we have $r = m\frac{s}{k}$ .... (49)

Where m is a constant, we get

$$x = \int \frac{ds}{\sqrt{1 + \frac{m^2}{k^2}}} = \frac{S}{\sqrt{1 + \frac{m^2}{k^2}}}$$

and

$$y = \int \frac{\frac{m}{k} ds}{\sqrt{1 + \frac{m^2}{k^2}}} = \frac{\frac{m}{k} S}{\sqrt{1 + \frac{m^2}{k^2}}}$$

Whence

$$y = \frac{m}{k} x \quad \ldots\ldots (50)$$

This gives for streamlines, a pencil of straight lines.

Or, again, if we have

$$r = a\frac{s^2}{k^2} + c\frac{s}{k} \quad \ldots\ldots (51)$$

Where a and c are constants, we get

$$x = \frac{k^2}{2a} \log \left[\frac{2a}{k^2} s + \frac{c}{k} + \sqrt{1 + (\frac{2as}{k^2} + \frac{c}{k})^2} \right] \quad (52)$$

and

$$y = \frac{K^2}{4a} \sqrt{1 + (\frac{2as}{k^2} + \frac{c}{k})^2} \quad \ldots\ldots 53)$$

From which we get

$$(1 - e^u)^2 = 4e_u \left(\frac{16a^2y^2}{K4} - 1 \right) \quad \ldots\ldots (54)$$

Where exponent $u = \frac{4ax}{K^2}$.

We can readily get the value of the normal force for the relation expressed by equation (51), by substitution in eq. (30). This gives

$$P_n = \frac{W k^2 Q_o^2}{2g} \quad \frac{1}{b^2[\frac{2ab}{k^2} + \frac{c}{k}]^2} - \frac{1}{s^2[\frac{2as}{k^2} + \frac{c}{k}]^2} \quad (55)$$

For any fixed value of k, this equation gives us the variation of P_n along a streamline; for both s and k variable, it gives us the value of P_n anywhere in the plane. This or any of the equations in r and s given can readily be transformed into rectilinear co-ordinates if desired.

TO ELECTRICITY.

By thy swift power a human life may be
Destroyed or saved in one brief instant, and
The labor that is hourly done by thee
Would tire a million men, if done by hand.
I hail thee as one of the greatest powers,
Submissive to control by mind of man.
Each year, in this great, wondrous world of ours,
New gulfs en route world-progress thou both span.

—Chas H. Meiers.

GOVERNMENT CO-OPERATES IN TIMBER SALE.

Co-operative arrangements announced by the departments of agriculture and the interior make possible the offering for sale of 630 million feet of merchantable timber in Southeastern Arizona.

The stand covers the southeastern corner of the Sitgreaves national forest, the northwest edge of the Apache national forest and the Fort Apache Indian reservation. Besides 600 million feet of yellow pine timber, there is 30milllion feet of less important species, including Douglas fir, white fir, Engelmann spruce, Mexican white pine, blue spruce and cork bark fir.

Separate bids and contracts must be made for the timber upon the national forests and that upon the Indian reservation. Ten years will be allowed for the removal of the timber after the beginning of the cutting period, although a sufficient period will be given first for the construction of logging roads, mills, etc.

The opening up of this great body of virgin timber, is due to the determination of the departments of the interior and agriculture to pool their acreage in the locality described. By combining timber on the two adjoining national forests, the Apache and the Sitgreaves, with the stand on the Fort Apache Indian reservation, a natural logging unit of sufficient timber is presented to warrant the extensive and costly constructive work which the marketing of the timber requires.

PACIFIC COAST A. I. E. E. CONVENTION.

The fourth annual Pacific Coast convention of the American Institute of Electrical Engineers convened at Vancouver, B. C., September 9-11, 1913. While somewhat more limited in attendance than some of its predecessors from many standpoints, it was the most successful yet held, particularly as regards the value of the excellent discussion made possible by considering but one paper at a session. The total registration was 154, of which one-third came from outside points.

The first session on Tuesday afternoon was opened by an address of welcome by a representative of Vancouver's Mayor. Chairman R. F. Haywood then introduced Vice-President J. A. Lighthipe who hereafter presided at all meetings.

In the absence of the author, V. M. Greisser's paper on "Snow and Ice Loading on Transmission Lines," was read by C. F. Uhden. An abstract of the paper follows:

Wires hung from suspension insulators do not maintain their relative positions as closely as when pin type insulators are used, owing to the deflection of the insulators with unequally loaded spans. During the winter season a transmission line of the Washington Water Power Company was rendered almost useless due to short circuits caused by the stretching and sagging of the wires when unequally loaded with ice, which falls from some spans sooner than others.

A series of tests upon an experimental line was made to determine (1) the influence of the loaded line upon the elasticity of the cable; (2) the effect of swing of insulators; (3) the effect of using strain insulators at short intervals, and (4) the combined effect of these conditions.

The manner of making the tests is described and the results are shown graphically, the conclusion being that the conductors should not be placed in a vertical plane and also that even if arranged horizontally the conductors will sag within unsafe distances of the ground. It is recommended that high voltage insulators should be shortened, spans shortened and transmission lines built with disregard to all the stresses which will develop in the supporting structures and conductors.

The discussion was opened by J. B. Fisken who emphasized the fact that the engineer should inform himself on the method of formation of sleet and frost and so anticipate possible trouble.

F. D. Nims told of experience with snow in heavily forested sections whereas in non-protected areas little difficulty was experienced. R. F. Haywood suggested that pin type insulators, being rigidly supported, caused less trouble than the flexible suspension, though Paul Lebenbaum believed that the electricity of the wire was also a contributory factor. W. V. Hunt suggested that damage could be obviated by a shorter spacing of towers, more frequent dead-ending and also by lengthening the center cross arm. T. R. Cornick corroborated these statements, but questioned the advisability of using suspension insulators for short lines of less than 60,000 volts. Chairman J. A. Lighthipe stated that the experience of the Southern California Edison Company had demonstrated the superiority of the suspension type which were gradually being used to replace all pin insulators on their 75,000 volt line, the pin type cracking after four or five years' service. A. A. Miller also cited the success of the Montana Power Company with the pin type.

F. D. Nims suggested that a combination insulator, such as that made by the Pearson Engineering corporation, seemed to promise well. J. B. Fisken stated that spans were entirely too long, unless higher towers and stronger wire were used. V. Karapetoff stated that the factor of safety in a transmission line was not large enough to insure continuity of service, these statements being challenged by A. H. Babcock, because the reliability resulting from extreme engineering care is seldom justified by the subsequent earning capacity.

A. H. Babcock's paper on "Mountain Railway Electrification" is published in full elsewhere in this issue. An appendix comprising a convenient and quick method of determining the feeder and substation layout in preliminary studies was developed by F. E. Geibel, other appendices showing the details of generating station costs and other features more briefly summarized in the report, G. W. Welsh also having collaborated in their preparation.

Chairman J. A. Lighthipe told of the entire change in Mr. Babcock's opinion as to electrifying the Sierras since the first study of the problem. The discussion related chiefly to the relative efficiencies of oil fuel and the possibility of future electrification. The former was participated in by A. A. Miller, H. W. Beecher and the authors, the latter by J. R. Fisken, Paul Lebenbaum, R. F. Haywood, V. Karapetoff, J. A. Lighthipe and the authors, somewhat along the lines suggested in an editorial in this issue.

E. P. La Belle and L. P. Crim presented a paper describing the construction and laying of "The Gulf of Georgia Submarine Telephone Cable," a continuously loaded submarine telephone cable between points near Vancouver and Nanaimo,, a distance of 14.2 miles. After a careful study of the relative advantages of a continuously loaded and a coil loaded cable for these special conditions, the results have justified the selection of the continuously loaded type. This paper and discussion will be published in an early number of this journal.

On Wednesday evening Vladimir Karapetoff, professor of electrical enginering at Cornell University, gave a musical recital and interpretation which was greatly enjoyed by all present. A. H. Halloran showed a large number of lantern slides of the "Engineering Features of the Panama-Pacific Exposition" as an accompaniment to a lecture on the subject. This evening meeting was held in the rooms of the Progress Club, a supper being served at the conclusion.

On Thursday morning John B. Fisken presented "A Modern Substation in the Couer D'Alene Mining District," as built by the Washington Water Power Co. to supply three-phase power at 2300 volts to the Bunker Hill and Sullivan mines. The paper gave a detailed account of all the euipment and cost of a structural steel portable station supplying 3000 h.p. to various motors at the mine. A table of distribution of cost of electric light and power for the average month is given which shows the cost of this service for different mines operated.

Much of the discussion centered around the adaptation of such portable substations to other industries. F. D. Nims questioned the use of three-phase rather

than single phase transformers. R. F. Haywood emphasized the influence of the exacting service demanded from mines in creating improved design for other requirements. F. B. Fisken explained that the saving in weight and in space justified the use of three phase transformers, especially under the difficult conditions of transportation in this instance. He stated that the prime reason for adopting Y-connection was that it reduced the strain on all apparatus.

In the absence of the author, K. C. Randall's paper on "High Voltage Circuit Breakers" was read by A. A. Miller. This paper showed the details of construction and operation of a switch wherein a reactance was introduced to limit the current to a value readily ruptured.

This paper was discussed by L. G. Robinson, J. B. Fisken, W. W. Fraser, V. Karapetoff and A. A. Miller.

In the absence of E. J. Barry his paper on "Logging by Electricity" was read by Mr. Herring, who also introduced the discussion by giving many facts and figures upon the use of electricity in the lumber industry. These were supplemented by much interesting information from E. F. Whitney, all of which will be printed herein as soon as available. As this concluded the list of papers the technical sessions were declared closed.

Entertainment Features.

On Thursday evening a magnificent banquet was served in the Terminal City Club, which institution had also extended all its privileges to the visiting engineers. By the American visitors the showing of true Canadian hospitality was deeply appreciated and will long be remembered. During the evening it was unanimously decided to recommend that the next Pacific Coast convention be held at Spokane, Wash., at the time of the Northwest Electric Light & Power Association's meeting.

R. F. Haywood presided and introduced the various speakers, whose remarks all sparkled with humor and epigrams.

Following is the toast list:

"THE KING."

"THE PRESIDENT OF THE UNITED STATES."

"THE PROVINCE OF BRITISH COLUMBIA."

Proposed by Mr. William McNeill.

Responded to by Mr. H. H. Stevens, M. P.; Mayor Baxter.

"AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS."

Proposed by Mr. R. F. Hayward, Mr. R. H. Sperling.

Responded to by Mr. J. A. Lighthipe, Mr. A. H. Babcock, Mr F. L. Hutchinson.

"KINDRED SOCIETIES."

Proposed by Mr. R. W. Pope.

Responded to by Mr. G. R. G. Conway.

"THE TECHNICAL PRESS."

Proposed by Prof. Karapetoff.

Responded to by Mr. A. H. Halloran, Mr. N. A. Bowers.

"GOD SAVE THE KING."

On Friday the delegates were the guests of the Western Canada Power Coompany while visiting their new power plant at Stave Falls. After a pleasant ride by rail and an inspection of the plant a sumptuous lunch was served. In the afternoon the party enjoyed a boat ride on Stave Lake, greatly admiring the wonderful scenery en route. Upon returning tea was served, when the visitors expressed their hearty appreciation of the royal hospitality extended them by Mr. Haywood, Mr. McNeill, Mr. Nims and the other officials of the company.

On Saturday the British Columbia Electric Railway Company were the hosts on a steamer trip to the new Lake Buntzen plant on North Arm. Lunch was served in the high tension room while tea was served after the plant and lake had been inspected. This trip also was an inspiration to those fortunate to be present and it was unanimously and vociferously decided that nowhere have greater hospitalities been enjoyed than in British Columbia.

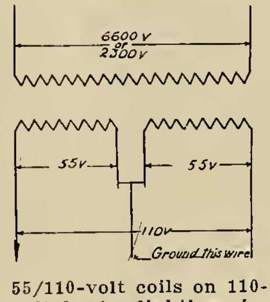
Thus was brought to a conclusion a convention which will long be remembered as a monument to the untiring members of the Vancouver section, whose several committees so thoughtfully anticipated every wish of the visitors. Particular credit is due to Chairman R. F. Haywood and Secretary E. M. Breed for the general arrangements as well as to F. D. Nims for the excellent papers.

STANDARD METHOD OF GROUNDING SECONDARIES OF TRANSFORMERS.

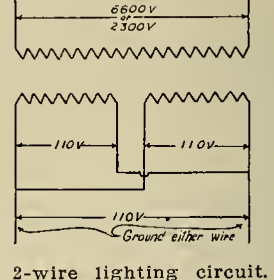
There has arisen a great demand for the diagrams showing the actual methods to be pursued in grounding transformers to comply with the new mandatory rule of the National Electrical Code Edition, 1913. Also a great many of the State Commissions are demanding grounding of the secondaries of distribution systems which intensifies this demand.

Through the courtesy of Mr. D. F. McGee, chief engineer of the Pacific Power & Light Company of Portland, Ore., the Journal has been given permission to print their actual drawings.

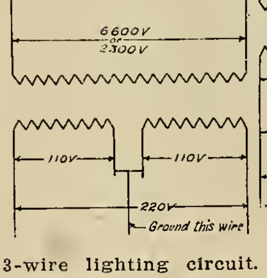
Grounding according to these methods outlined has been carried out in all of their properties in the northwest with satisfactory results.



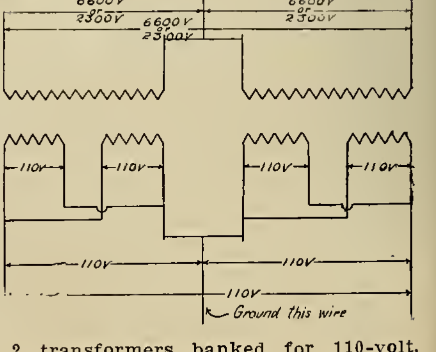
55/110-volt coils on 110-volt 2-wire lighting circuit.



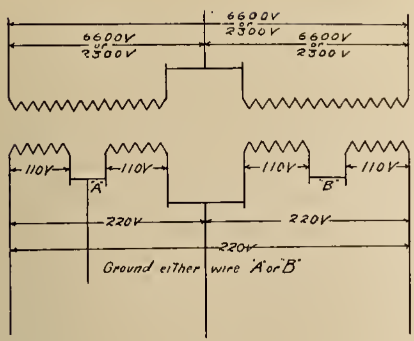
2-wire lighting circuit.



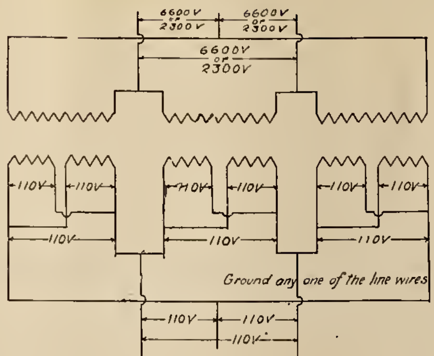
3-wire lighting circuit.



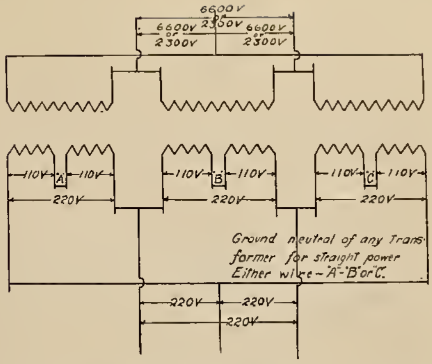
2 transformers banked for 110-volt, 3-phase, open-delta, light or power.



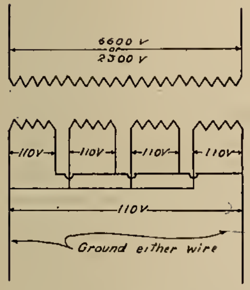
2 transformers banked for 220-volt, 3-phase, open-delta power. This also holds for light and power circuits where light is taken off transformer having grounded neutral.



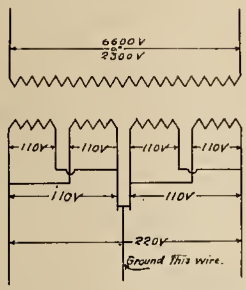
3 transformers banked for 110-volt, 3-phase, closed-delta—light or power. If used for power, and lights are also connected—preference should be given to one side of lighting circuit.



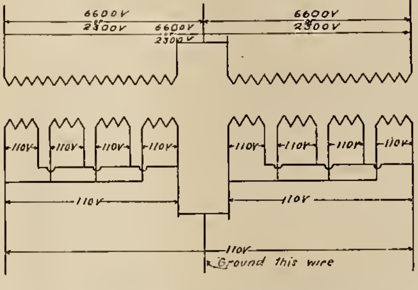
3 transformers banked for 220-volt, 3-phase, closed-delta power. Ground neutral of transformer which is supplying lights, and under no circumstances should more than one wire be grounded.



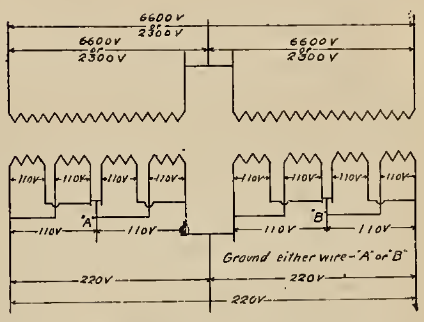
4 - coil secondary transformer on 2-wire lighting circuit.



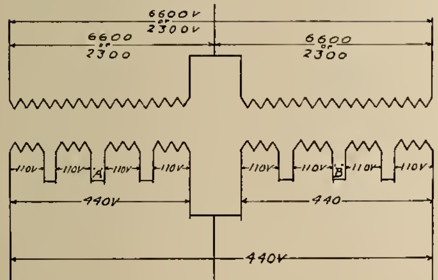
4 - coil secondary transformer on 3-wire lighting circuit.



4-coil secondary—2 transformers on 110-volt, 3-phase, open-delta, for light and power circuits

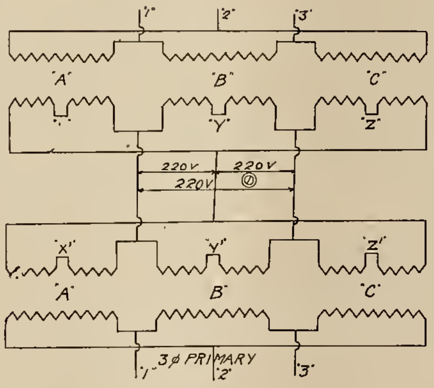


4-coil secondary—2 transformers on 220-volt, 3-phase power. If lights are also connected, ground neutral of transformer carrying lights—not more than one wire to be grounded.



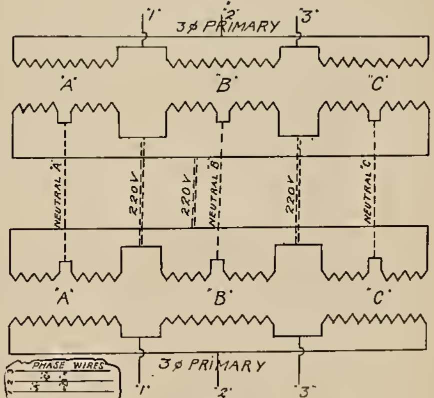
4-coil secondary—2 transformers on 440-volt, 3-phase power.

NOTE.—Grounding either point "A" or "B" will allow of a maximum voltage to ground of 380 volts. Danger from shocks to employees or others working on such circuits is **more** serious than the danger from the breaking down between primary and secondary, or crosses with high-tension lines. Therefore, circuits of this voltage **shall not** be grounded.



2 banks of 3 transformers connected for 220 - volt, 3 - phase, closed-delta power. Ground either point—x, y or z and the corresponding point on the other bank—x', y' or z'.

If for any reason any transformer in either bank is put out of service it will likely be necessary to change ground wire into secondary system. This change will require that ground tap be changed at each bank and care should be taken to maintain proper phase relations.



2 banks of 3 transformers connected for 110/220-volt, 3-phase, closed delta. If for any reason any one of the transformers in either bank be put out of service it will likely be found necessary to change ground wire to secondaries.

Neutral of transformer doing heaviest lighting duty should be grounded. If transformers are doing 220-volt, 3-phase power duty only, so that neutrals are not strung through, the neutral of same phase transformer should be grounded at each bank—not more than one wire to be grounded—and see that it is proper phase relation.

Standard Methods of Grounding Transformer Secondaries. Case to be grounded in every instance except as noted.

PACIFIC COAST GAS ASSOCIATION CONVENTION.

The twenty-first annual convention of the Pacific Coast Gas Association met at San Jose, Cal., on September 16, 17 and 18. After the usual business meeting on Tuesday morning President C. S. Vance presented the following address:

"Owing to the death of Mr. Henry E. Adams, whom we elected to the office of president at the last convention, it devolved upon me to take up the reins of the association, and to preside over the twenty-first annual convention, though it is with a feeling of deep regret that I do so under such sad circumstances.

"We meet today in a typically prosperous and rapidly developing California city, a city famed for its beauty and well deserving its title 'The Garden City.' In the name of the association, I thank the chamber of commerce and the citizens of San Jose for their hospitality.

"The real worth of a meeting of this character lies in the reports of what has been accomplished by the various committees during the past year, and in the different papers which are presented for consideration. Realizing this, and bearing in mind the fact that the technical and engineering branches of our industry will receive attention in these papers, I will but briefly touch upon a few important matters most vitally affecting the interests of our organization.

Gas Manufacture and Distribution.

"During the past year there has been a very noticeable increase in the number of central stations for gas distribution. The smaller companies have shown a tendency to either sell to or consolidate with larger concerns. This is of great benefit to the gas industry generally, as it tends to a betterment of service and a lower gas rate, and gives the consumer a superior and more even product. Again, it furthers the development of high pressure distribution and is instrumental in supplying, not only the smaller country towns, but farms and ranches wherever the lines pass, which would not otherwise justify service for many years to come.

"Development along purification lines seems to have been confined to efforts to eliminate naphthalene, the oil scrubber being adopted as the medium along the Pacific Coast.

"The disposition of carbon, the principal by-product of oil-gas manufacture, by means of mechanical separation and manufacture into either briquets for domestic fuel or bricks for fuel use in plants, has, during the last year, been adopted by a number of gas companies on the Pacific Coast. The Los Angeles Gas & Electric Corporation is the pioneer in this branch of the gas industry, and it is pleasing to see others profiting by its experience. Last winter, the demand for commercial briquets in Los Angeles was beyond all expectations and taxed to the utmost, the capacity of our transportation department.

"Regarding the gas generator, there seems to be a tendency toward the installation of larger units. Much study has been given to the reduction of manual labor, to the end that the operator may devote his energies to more intelligent supervision of the generators. This results in higher efficiency, both as regards oil consumption and maintenance of the generator in general.

"There have been some experiments to make oil gas under pressure, under the same theoretical conditions as now exist, except the increasing of the pressure to thirty pounds. To date, as far as I know, nothing worthy of mention has been established, as these experiments are yet in their infancy. However, the principles involved are correct and later developments may prove of great interest.

Natural Gas.

"Great progress has been made in the natural gas industry in California during the past year. The Midway Gas Company has completed a gigantic enterprise which bids fair to effect a great change in the gas business in and around Los Angeles. From the natural gas fields in the Buena Vista Hills, Kern county, to Los Angeles, a distance of about 120 miles, a 12 in. pipe line has been built, and huge compressors, to increase the carrying capacity of the line, are being installed. A number of gas wells have been completed and more are being drilled.

"As no papers are to be presented on natural gas, I think it might be well to say a few words regarding its use and the results obtained therefrom.

"The Los Angeles Gas & Electric Corporation is now using natural gas as fuel under its boilers and for heating the oil gas generators, and finds it very satisfactory, especially in the latter capacity. Here it has proven an ideal fuel for obtaining what is known as "surface combustion." This combustion, taking place above the firebox arches, further reduces the repair item to this portion of the generator. It has also been observed, in the use of natural gas for heating the generators, that it is possible to make a finer adjustment of heat, owing to the fact that the amount of blast can be properly regulated, this being possible because there is no smoke to contend with, as is the case when using fuel oil for heating. Further, it is easily possible to get a more even, or flexible, distribution of heat desired. The natural gas burner used in the generators is of the most simple construction, being nothing more than a two-inch standard wrought iron pipe with an ordinary regulating gate valve. This is connected to the generator, in place of fuel oil burner, alongside of blast nozzle. This gas contains about 1000 B.t.u. per cubic foot, according to recent tests, and a year's experience with this fuel should demonstrate its efficiency as compared with California crude oil.

Legislation.

Since the adoption in 1911 of amendment to Section 23 of Article XII of the Constitution of the State of California giving to the railroad commission certain powers of control over gas and electric companies and other utilities, there has been a growing sentiment in favor of the surrender to the commission of the power of rate regulation expressly retained by municipalities of the State under the constitutional provision. Several cities have already held special elections for this purpose, notably, Ualo Alto, Orange, Willits, Covina, Monterey, Salinas, Eagle Rock, Antioch, Ontario and Belvedere. Recognizing this condition, the legislature, at its recent session, proposed to the qualified electors of the State, a further amendment to this section of the

constitution giving the railroad commission additional power to regulate rates of such utilities in all municipalities throughout the state. This amendment is known as assembly constitutional amendment No. 62, and will come before the people at the next general election, or earlier should a special election be held at which such proposition could be submitted.

International Gas Congress.

"The invitation extended by our organization to the American Gas Institute asking that body to attend the International Gas Congress to be held in San Francisco in 1915, has been accepted, and the institute has taken charge of the issuing of invitations to the other gas associations. Most of these invitations have been accepted, and delegates have been appointed to the Gas Congress Committee. In view of the fact that these associations will meet in San Francisco as our guests, it is incumbent upon us to make their visit a memorable one, and in order to accomplish this, it is absolutely necessary that all the members lend their support and co-operation to this enterprise. There is considerable work to be done between now and the time of this meeting, and it behooves us all to put our shoulders to the wheel and do our utmost toward making a success of the most important project ever started by this association. Mr. E. C. Jones, our delegate to the Gas Congress Committee, will tell us in detail what has been accomplished by the committee since our last meeting.

Gas Engineering Course.

"It is indeed very gratifying to note the success which has met our efforts to establish a course leading to the degree of gas engineer in the University of California. During the past year, that institution has made the degree part of its curriculum, and reports indicate that the students are taking a lively interest in this study. This work has been well begun, and it rests wholly with the members of the association as to whether or not it will be pushed into a successful conclusion. I know that we will all be interested in hearing more about this great undertaking for which the association is responsible, and the report from the chairman of the committee in charge will, no doubt, cover all the details.

General.

"Our other programs have been open to criticism because of the fact that too many papers were presented and too little time given to discussion. We have agreed that the number of papers to be read should be held to a minimum, thus giving all of the members an opportunity to discuss them. The interchange of ideas brought about by such discussion cannot help but be of educational benefit to us all. We hope that everyone will take a personal interest in whatever questions may be brought before the convention.

"In thanking those members who have put forth their energies to make this convention a success by presenting papers on subjects of practical interest, I must say that we are fortunate, indeed, in having selected men who are especially well-fitted for this work. I wish also to express my appreciation of the work done by the various committees, and to thank those members who have assisted in the work of the association during the year. I hope that this meeting will be a source of great benefit and pleasure to all."

Technical Sessions.

The following papers which were read and discussed at the technical sessions on Tuesday and Wednesday will be published in full in early issues of this journal, together with the chief points brought out in the discussions: **"Oil Gas,"** by Leon B. Jones, **"Industrial Uses of Gas,"** by John B. Redd; **"Rate Making,"** by Dr. A. C. Humphreys, **"Modern Gas Distribution and the Part Played by the Automobile,"** by D. E. Kepplemann; **"Why the Gas Company Should Handle Gas Arc Lamps,"** by C. B. Babcock; **"Gas Company's Public Policy,"** by L. A. Wright; **"Standard of Quality and Service for Oil Gas,"** by H. Papst; **"Wrinkles,"** by H. W. Burkhart; **"Experiences,"** by John Clements; **"Novelties,"** by H. P. Pitts.

At the regular business meeting Long Beach was chosen as the next meeting place. The following officers were elected: President, C. S. Vance, Los Angeles; vice-president, E. C. Jones, San Francisco; secretary-treasurer, Henry Bostwick, San Francisco. Directors—John A. Britton, San Francisco; William G. Kirckhoff, Los Angeles; William Bourhyte, Los Angeles; F. A. Green, Long Beach; C. B. Babcock, San Francisco.

Entertainment.

The annual banquet was held in the Hotel Vendome on Wednesday evening and on the following morning the delegates were the guests of the Pacific Gas & Electric Company on a trolley ride around the loop on the Peninsular Railroad. The party, leaving San Jose at 10 o'clock, proceeded to Saratoga and Los Gatos, returning to San Jose by way of Campbell. From there they went through the orchards of Berryessa to the famous Alum Rock Park where luncheon was served. In the afternoon dancing and other amusements were indulged in until 5 o'clock when the party returned to San Jose.

PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

The Exposition Company has closed the gates to free public admission and is charging the nominal sum of 25c for adults, 10c for children and 50c for automobiles. Work is progressing rapidly and seems certain that all of the exhibit palaces will be completed nine months before the opening date. At present 25,100 ft. of high pressure water pipe has been laid, about 40 per cent of the total; 80 per cent of the work on the Machinery Palace has been completed, 1,070,000 ft. of lumber being erected during the month of August. About 40,000 ft. of the finished roofing has been completed. All lumber for the Palace of Education has been received, and since August first, 375,000 ft. have been placed in position. Nearly all the structural work for the Food Products Building has been framed. The conduit system for the Exposition Building section is nearly half completed. Nearly 2,000,000 ft. of lumber has been placed below the first floor in the construction of the Agricultural Palace. The first floor work on the Manufacturers' Building has been completed and the framing of columns and trusses is going forward rapidly.

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POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
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Entry changed May 1. 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Electrical Lumbering

Pacific Coast electrical engineers are giving much attention to the application of electric power to the lumber industry. As has been noted from time to time in these columns it has been successfully applied to sawing, planing and haulage, and as may be noted elsewhere it has now been adapted to logging. E. J. Barry's paper on "Logging by Electricity" brought out a most interesting discussion at Vancouver and next week this subject will occupy the center of the stage in the Logging Congress at Spokane, Wash.

Little argument is now needed to convince the average millman that electric drive in the sawmill is the ideal form of power, but the question as to whether this power should be generated by the mill or purchased from a central station is still open for discussion. One side of this question was recently discussed in these columns in favor of the former procedure. Even where the costs are about equal the laws of most of the Western States forbid that the refuse be dumped into streams or left standing on the ground. Unless it is burned to make steam some method must be devised for its utilization. Several unsuccessful attempts have been made to convert it into wood alcohol, considerable money having been expended in one plant at Port Havelock which has now been abandoned. At Tacoma the sawdust and "hogged" wood is used to make briquets, though the demand at present is somewhat limited. At Vancouver, B. C., extensive experiments are being conducted on the distillation of turpentine, an electric furnace being used to insure absolute control of the temperature. The U. S. Forest Service also are working towards the conservation of this waste. As a matter of fact, this is a subject of vital concern to central stations for by making this by-product of value it will no longer be economical to use it as fuel.

As regards electric logging, the great money saving quoted by Mr. Barry is only one item in favor of its adoption. Of far greater importance is its elimination of the fire risk. This year one mill in the Pacific Northwest shut down early in June because afraid of fire and thus lost the best part of the year. It is quite likely that in time the state and national governments will forbid the use of donkey engines for logging where electric power is available.

From a central station standpoint a single logging equipment is not desirable because of its low load factor, but where two or three outfits can be put on a line the initial cost is reduced in proportion. Tests have shown that it requires about 10 kw.-hours to bring in a thousand board ft. of lumber. When it is considered that there are now over two thousand donkey engines in the State of Washington alone, that one-half of Oregon's industrial population is employed in this lumbering and that these two States contain one-third of the standing timber in the United States, it may be realized that the central station and electrical manufacturer is vitally interested in the application of electricity to this great industry.

Mountain Railway Electrification

From a financial viewpoint perhaps the most important of the several excellent papers presented at the Pacific Coast convention of the American Institute of Electrical Engineers at Vancouver, B. C., last week was that wherein A. H. Babcock so forcefully demonstrated that electrification of the Southern Pacific Company's lines over the Sierra Nevada Mountains was not commercially feasible under existing conditions. This conclusion has been reached only after several independent investigations which were initiated with what might almost be called a favorable prejudice, if such a feeling can ever be ascribed to an engineer. As may be noted elsewhere in these columns, the paper and appendices present a careful analysis of the costs of electric construction and operation as compared to those of steam operation, the former showing a net loss, whether power is generated by the railway company or purchased from a central station.

At first reading this paper is distinctly disappointing, especially to those who may have apparatus or current to sell. But when it is considered that the figures would not be materially changed if the power cost nothing and furthermore that the exacting requirements of this particular installation are not comparable to other great projects, it forms a fitting inspiration in showing how the problem should be attacked.

That is costs three times as much to convert a mountain railway from steam to electric motive power as to electrify an interurban road is due not so much to the high cost of electrification as to the high fixed charges of steam railway construction. The great overload capacity of the electric motor enables it to negotiate grades which could not be approached by steam locomotives. As a result, fewer tunnels are necessary, less grade and fill, and fewer curves. The saving in the initial cost of an electric as compared to a steam right-of-way would more than pay for the cost of electrification.

Finally direct financial profit from the initial investment is not the only factor to be taken into account. In the matter of safety and convenience, low operating and maintenance charges, and other advantages, as pointed out by the author, "the profits from electrification must be realized indirectly rather than directly."

The Importance of the Load Factor

Mining, lumbering and railroading are the three great industries in the West, aside from agriculture, to which electric power must be applied. Yet when owners object to the rate which they are asked to pay for electric power they cannot understand that it is largely due to the low load factor which characterize each of these industries. A brief explanation of the term may aid in an understanding of its effect.

"Load factor" is a ratio, usually expressed as a percentage. Ordinarily this ratio is that of the average demand for power during a given period to the maximum demand during the same period. It is frequently applied to a twenty-four-hour period, though there is no reason why it should be so limited. With many Western companies the annual load factor is as perplexing as the daily load factor. The greater amount of electric lighting in the winter months seldom compensates for the decreased load of irrigation pumping which operate during the summer, whereas the Eastern manager usually figures on a winter peak. Considering the daily load factor, electric logging or mountain electric railways have a load factor of only about twenty per cent.

A low load factor means that sufficient apparatus must be installed to care for the maximum demand. This necessitates duplicate units and large generating capacity which is idle during periods of average and minimum demand. Unlike water or gas, alternating current cannot be stored, but must be manufactured for instant use at a moment's notice. While a storage battery can be installed to increase the efficiency of a direct current plant by improving its load factor it is necessarily expensive and increases the cost per kilowatt-hour as compared to a plant with a good load factor.

The transmission and distributing system, also, must be designed to care for the maximum amount of power which it will be called upon to deliver. With a low load factor a large investment is thus frequently idle for a large part of the time. This is one of the main reasons why many central stations have not been more energetic in introducing electric ranges, as a large investment in copper and in transformers must first be made.

From the foregoing it is seen that the cost of generating and distributing a given amount of electric power is largely dependent upon the load factor. Consequently the cost to the consumer may vary within wide limits due to the fixed charges required to properly equip a plant for its peak load.

International Engineering Congress

A detailed announcement of the plan for the International Engineering Congress at San Francisco in 1915 has been made by the Committee of Management as a result of numerous suggestions and conferences. In order that the congress may be self-supporting to some extent it is proposed to publish the transactions in the form of ten or more large volumes, each dealing with some one of the several main branches of engineering with which the congress is to be concerned and constituting a comprehensive survey of the present state of the art.

Membership in the congress may be obtained upon payment of a nominal fee, which also entitles the subscriber to any single volume which he may desire, together with the privilege of securing additional volumes at a sliding scale of prices to be determined later. This project is worthy of the financial and moral support of every engineer in the West and as such is heartily commended to our readers.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Edward L. Moreland has been appointed manager of the Boston office of D. C. and Wm. B. Jackson.

J. O. Case, of the General Electric Company, Los Angeles, spent a few days during the week in San Francisco.

O. A. Schlesinger, manager United States Light & Heating Company, San Francisco, returned Thursday evening from a business trip to Los Angeles.

R. L. Douglas, commercial department, San Joaquin Light & Power Company, Fresno, Cal., was at San Francisco this week.

R. H. Henderson, formerly Manager of Works of the Westinghouse Lamp Company, Bloomfield, N. J., has resigned his position to engage in other work.

G. I. Kinney, manager San Francisco branch Fort Wayne Electric Works, has gone south for a few days. He attended the Pacific Coast Gas Association convention at San Jose this week.

W. F. Neiman, sales manager of the Great Western Power Company, who has been confined to his home recently from a mild attack of appendicitis was at his office again during the week.

Mr. Blosser, at one time salesman for the Holophane Works of the General Electric Company, and the Fostoria Glassware Company, on the Pacific Coast, has accepted a position with the H. W. Johns-Manville Company, in the illumination engineering and sales department, at Milwaukee.

D. R. Wedgewood, formerly salesman for the Crocker-Wheeler Company has become connected with the electrical department of Fairbanks, Morse & Company's San Francisco office. Mr. Wedgewood was at one time employed by the Great Western Power Company and is well fitted for his new position.

Glenn Marston, Associate Editor of "Public Service," was a Salt Lake visitor last week. He is on his way East from an investigation of public utility conditions on the Pacific coast. He made a thorough examination of the system of the Utah Light and Railway Company and reports that conditions there compare favorably with those existing in other parts of the West.

H. S. Black has been appointed Manager of Works of the Westinghouse Lamp Company, Bloomfield, N. J., to succeed **R. H. Henderson**, resigned. Mr. Black has had considerable experience in the engineering and manufacturing department of the National Quality Lamp Division of the General Electric Company. For the last three years he has been directing the work of the St. Louis factory of this company, in which he has been unusually successful.

T. E. Barlow and wife, **T. E. Berger**, **T. E. Bibbins**, **H. V. Carter**, **A. H. Elliott**, **S. P. Gregory**, **Brewster Hall** and wife, **C. B. Hall**, **C. C. Hillis**, **R. B. Holabird**, **F. H. Murray**, **A. H. Neylan** and wife, **F. H. Poss**, **H. E Sanderson**, **C. E. Wiggin**, and **Garnett Young** left Tuesday evening in a special car on the Southern Pacific to attend the Pacific Coast Jobbers' Convention at Gearhart Park, Oregon. **A. H. Halloran** and wife, returning from the Pacific Coast Convention of the American Institute of Electrical Engineers at Vancouver, B. C., joined the party at Portland.

H. W. Reynolds has been appointed by the United State government to a professorship of mechanical engineering in the University of the Philippines and will sail from San Francisco the early part of next month. Mr. Reynolds was graduated from the University of Pennsylvania in 1899 and was associate professor of mechanical engineering at the University of California for eight years. The University of the Philippines already has an excellent department in civil engineering, and Mr. Reynolds will start the new department to meet the growing demands for such work. He was employed by the Imperial Chinese government two years ago and realizes the possibilities existing in the Far East. He has been connected with the San Francisco office of Chas. C. Moore & Company for the past year, and during his connection here and at the University of California has made many friends who will wish him success in his new work.

MEETING NOTICES.

Electrical Development and Jovian League of San Francisco.

The regular monthly business meeting was held Tuesday of this week. The minutes of the previous meeting and the treasurer's report were adopted and reports of the various standing committees were heard and placed on file.

Announcement was made by the entertainment committee of the acceptance by Mayor Rolfe of San Francisco to address the league at the meeting of September 30th.

A committee was appointed to co-operate in an effort to have various local, national and international electrical and engineering organizations, who contemplate holding their 1915 meetings in San Francisco, and who may not have yet selected their dates of meeting, join in the idea of having all such meetings held at one particular time or season of the year.

Los Angeles Jovian League.

The Jovian Electrical League of Southern California meets every Wednesday at 12:15 p. m. at Christophers, 551 South Broadway (upstairs). There will be an interesting speaker at each meeting. In the future weekly postals will not be sent out, so get the habit now and attend regularly.

Salt Lake Jovian League.

The outing of the Sons of Jove and the Utah Electric Club at Lagoon on the 6th inst, was a complete success, both from the standpoint of enjoyment and attendance. One of the features of the afternoon was a baseball game which was indulged in by a number of members who did not have a very recent acquaintance with the little leather sphere. Three-legged races, sack races, potato races, ladies' races, etc., occupied the afternoon and early evening, when a most enjoyable chicken dinner was served by the Lagoon management.

Great preparations are being made by Statesman Brandenburger for the rejuvenation which will occur on October 4th. It has been found advisable to change the date from that at first contemplated to this latter date. It is expected that a large class will be introduced into the mysteries of Jovianism.

ELECTRIC RAILWAY EMPLOYEES' CONVENTION.

The Biennial Convention of the Amalgamated Association of Street and Electric Railway Employes of America was in session in Salt Lake during the past week. Mayor Samuel C. Park delivered an address of welcome to the convention Monday morning at 10 o'clock, which was responded to by W. B. Mahon, president of the association.

C. O. Pratt, who was the business agent of the Philadelphia local No. 477 which was suspended from the association for insubordination at the convention of St. Joseph, Missouri, two years ago, is in attendance at the convention, and is making every effort to have the Philadelphia union reinstated. To date no definite action has been taken. Mr. Pratt rented the Salt Lake Theater and in an impassioned address made an appeal for his fellow workers, which was favorably received by the large audience in attendance.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The Railroad Commission rendered a decision directing the San Jose Railways to reconstruct as a standard gauge line its narrow guage system from San Jose to Toyon Station, a distance of 4½ miles. The company was also directed to make connection at Toyon Station with the Peninsular Railway.

Ansel M. Easton was granted authority to sell the Black Hawk Water Company to the city of Burlingame for $5520.

The Western States Gas & Electric Company was granted authority to issue $354,000 of bonds for the purpose of refunding existing indebtedness.

A decision was rendered granting authority to Arthur W. Sloan and Frank Rosebrough to sell their water system in Nordhoff to the Ojai Power Company for $3000. The Ojai Power Company was authorized to operate a water system, to lease a water system from the Ojai Improvement Company, and to issue $10,000 of stock.

J. R. Anderson was granted a certificate of public convenience and necessity to operate a gas plant in Oakdale.

The Humboldt Transit Company was granted authority to execute a note in the sum of $20,000 to refund indebtedness.

A decision was rendered granting authority to the Southern Counties Gas Company to issue $6500 of bonds.

The commission dismissed the order of Fraser and M. Sallee against the Southwestern Home Telephone Company and the Pacific Telephone & Telegraph Company. The rates complained of had been remedied to the satisfaction of the complainant. The complaints of John W. Reese and J. A. Hoag were dismissed for the same reasons.

The Amador Electric Light & Power Company has applied for authority to sell $12,000 bonds and issue $3000 in stock. The proceeds from the sale of the bonds are to be used in paying existing indebtedness and making additions to the company's system. It is proposed to issue the stock to the estate of Mary A. Beacon as a stock dividend alleged to be due.

EDUCATING THE PUBLIC IN THE USE OF LIGHT.

Within the past month, the Illuminating Engineering Society has printed for several large lighting and manufacturing companies throughout the country, an edition of more than a quarter of a million copies of its illumination primer, "Light: Its Use and Misuse." It is being widely circulated by these companies for the purpose of creating an appreciation and demand for more and better light.

The recent edition of the primer, which contains a few minor changes in the original one, was published in a very inexpensive form so that it might be circulated at small cost. For the companies which are going to issue this pamphlet to their customers during the coming lighting season, the society in arranging to publish two new large editions, which will be available at prices that merely cover the publication costs involved. Sample copies may be obtained by interested companies upon application to the general offices of the society, 29 West Thirty-ninth street, New York.

TRADE NOTES.

Chas. C. Moore & Company, Seattle, have installed a condenser and some additional piping for the Alaska-Treadwell mine in Alaska.

The Robert Electric Works obtained the electrical contract for the wiring of the Modern Candy Factory's new building in Portland.

The Pacific Fire Extinguisher Company obtained the electrical contract for the wiring made necessary by the reconstruction of the Hamilton Building, Portland.

The Canadian Rand Company, through R. A. Williams, special Vancouver representative, has secured the central power plants, air compressors and equipment for construction of the double bore tunnel of the Canadian Pacific in the Northwest.

The Mechanical Installation Company, San Francisco, is installing a new crane and changing some of the wiring for the C. A. Smith Lumber Company at Bay Point, Cal. This is one of the most completely equipped electrical lumber plants in California.

Barr & Anderson, heating and plumbing contractors, Vancouver, B. C., have secured a $300,000 contract with the Hudson's Bay Company, for furnishing plumbing, heating, lighting, wiring and mechanical electrical equipment for the new Hudson Bay store at Vancouver.

The West Coast Engineering Company of Portland, Oregon, has completed the installation of power and lighting apparatus in the mills of the Hawley Pulp & Power Company of Oregon City. This work consists of generating equipment of 250 kw. capacity, motors for driving paper making machinery, and the complete overhauling of the lighting of the plant, and the wiring of a new concrete mill. The company has also installed an electric log unloader for the Silver Falls Timber Company, is overhauling the lighting system on the U. S. Government dredge Cletsop, and has the contract for complete electrical equipments of the new government dredges Multnomah and Waukiskum, being built at Portland.

The Pacific Electric Manufacturing Company, is engaged in shipping the following orders: Six 60 kilovolt poletop switches to the Pacific Power & Light Company, Portland; one hundred 3-pole 22 kilovolt poletop switches to the Southern California Edison Company, Los Angeles; two 66 kilovolt poletop switches to the Washington Water Power Company, Spokane; one 110 kilovolt and five 33 kilovolt oil switches to the Sierra & San Francisco Power Company, San Francisco; two 33 kilovolt oil switches to the Coast Counties Gas & Electric Company, Santa Cruz and five 45 kilovolt poletop switches to the Washington-Oregon Corporation, Portland.

BOOK REVIEWS.

Electric Wiring and Lighting. By Charles E. Knox, E. E., and Geo. E. Shaad, E. E. Size 5¾x6½ inches; 94 pages; 90 illustrations; cloth binding. Published by American School of Correspondence, Chicago, Ill., and for sale by Technical Publishing Company, Rialto Bldg., San Francisco, Cal. Price $1.00.

This book has been written especially for self-instruction and home study. It will probably be found useful as a handbook. The numerous illustrations showing methods of wiring and the frequent references to the National Electrical Code, make this book especially valuable to the young electrical contractor.

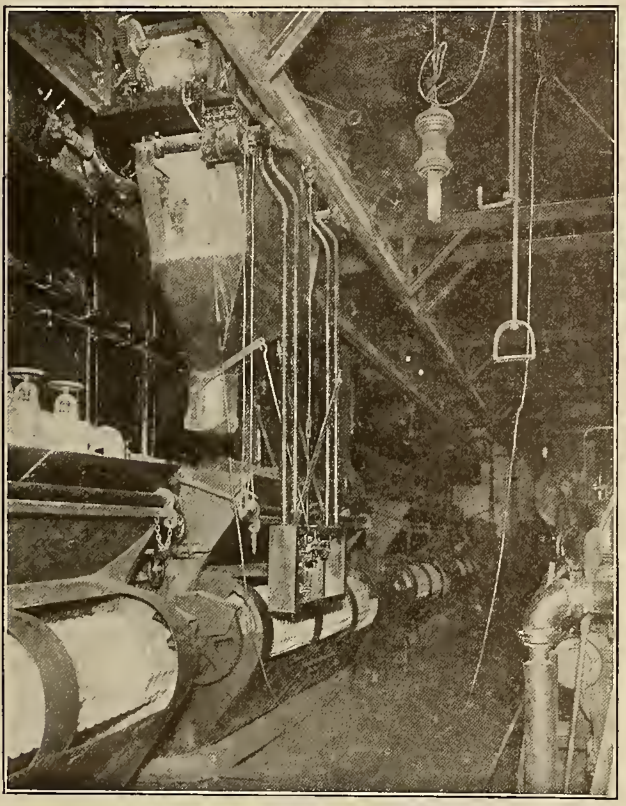
Walker's Manual of California Securities and Directory of Directors. By H. D. Walker, 454 Montgomery street, San Francisco; 525 pp.; 6x9. For sale by author and Technical Book Shop, San Francisco. Price $4.00.

The mere fact that this work now appears for the fifth year bespeaks its value. This fifth annual number has been enlarged and gives information regarding many companies not mentioned in previous issues, with additional information concerning those previously presented. The nine sections treat of state and municipal securities, banks, power, sugar and oil corporations, San Francisco street railway franchises, stock and bond quotations, and directory of directors. As a financial reference there is no other manual published which contains more detailed and complete information concerning local companies.

INDUSTRIAL

BOILER ROOM SCALE.

A suspension boiler room scale with special type registering beam, motor driven, has been recently installed by Fairbanks-Morse & Company, for the Puget Sound Traction, Light & Power Company, at their Post street station in Seattle. The scale was installed to secure a quick and accurate weight of all coal going into the seven automatic stokers. The car on which the scale and hopper is suspended is driven by a Fairbanks-Morse 2 h.p., 230 volts, direct current, series wound enclosed type motor, operated by a reversible crane type controller having five speeds forward and reverse.



Suspended Boiler Room Scale.

The weighing operation is simple. The type registering ticket, which is ⅝ in. wide and 14 in. long, is placed in the small metal tube just beneath the beam and the poise is set at the desired weight, in this case being 2100 pounds, the capacity of the hopper. The coal is then released from the bunkers above into the scale hopper until the beam balances. The small hand lever at the bottom of the poise is then pulled forward, stamping the correct weight on the ticket. When the hand lever is released the ticket moves forward one space ready for receiving the next impression. The operator then grasps the controller rope with one hand and the hopper gate lever with the other and distributes the coal evenly in the hopper above the stokers. The type registering ticket has space for 75 separate weighings, which is the maximum for an eight hour shift. At the end of each shift this ticket is removed and the weight totaled up, thus securing an undisputable record of the actual amount of the coal consumed. The scale can be easily run from one end of the building to the other in less than a minute, thus enabling the operator to feed the seven boilers without difficulty.

EDISON STORAGE BATTERIES AT THE CALIFORNIA STATE FAIR.

Perhaps one of the most interesting and instructive exhibits at the California State Fair is that of the Edison Storage Battery Supply Company. The booth itself is lighted by current furnished from Edison batteries, while a practical demonstration of a complete isolated house-lighting plant is made, affording visitors opportunity of seeing for themselves the advantages to which the batteries may be placed for lighting in the home and on the farm. Other uses to which the batteries may be placed and which will also be in practical operation, are railway signals and commercial electric trucks. The truck used in the exhibit is also a California product, being made by the Holt Brothers Company of Stockton, equipped with Edison batteries, and is intended for delivery purposes in Portland, where it will be shipped at the close of the fair.

The absence of lead and acid in the manufacture of these batteries has eliminated many of the disagreeable features of the old-style makes and has gone a long way in meeting the demand for a strong, compact and easily handled electric storage battery.

"EXIDE" STORAGE BATTERIES ON LOG RAFT.

In accordance with government regulations on the Columbia River, the log rafts—unquestionably the largest in the world—can only be towed down the river at night on account of the interference with navigation in the day time. For the purpose of safety these rafts must be equipped with lights at both the head and end of the rafts, a storage battery and lamp being suspended from poles set up on the raft. The electric light is placed directly over a case containing the batteries this doing away with practically all wiring. The lamp is equipped with two 4 candle power lamps wired in parallel and the battery consists of two 6 volt "Exide" batteries having a capacity of 100 ampere hours.

This electric raft light was designd by the Astoria Hardware Company, of Astoria, Oregon, and the batteries were furnished by the Electric Storage Battery Company of Philadelphia. This arrangement keeps the batteries at a considerable height above the raft, where there is no danger of their being washed over by heavy seas. This scheme has been used for sometime and has given perfect service.

NEW CATALOGUES.

Sanitary Dustproof Lighting Unit for Hospitals is the title of a leaflet recently issued by the Lighting Studios Company, New York.

The Pittsburg High Voltage Insulator Company, Derry Penn., have issued catalogue No. 3, which besides showing plans and specifications for insulators and accessories of standard and approved designs, gives a brief illustrated description of their factory and methods of designing, making and testing insulators.

Folder 4187, issued by the Westinghouse Electric and Manufacturing Company, covers the type KB Section Insulator. The iron parts of this device are sherardized, and wearing parts are renewable. It is said to be an unusually strong and light-weight insulator.

Leaflet No. 3569 issued by the Westinghouse Electric and Manufacturing Company, describes and illustrates the shipment of transformers in tanks with oil. This method has become very prevalent in the shipment of large transformers, enabling them to be installed immediately upon arrival at destination.

COMBINED AUTOMATIC AND MANUAL CONTROLLERS FOR ALTERNATING CURRENT FIRE PUMP MOTORS.

The controller for a fire pump motor must be simple in design, easy to operate and reliable. The Cutler-Hammer Manufacturing Company, of Milwaukee, have recently put a new type motor-driven fire pump controller on the market. The one shown in the illustration is for a 100-h.p, 440-volt, 3-phase, 60 cycles, slip-ring motor. Mounted on the control panel are a voltmeter, an ammeter, a three-pole rigid arm plain overload circuit breaker, a three-pole. double-throw knife switch, a pressure governor and a combined manual and automatic fire pump motor starter. At the back of the panel in a suitable angle iron frame are mounted the cast iron resistance grids, which are used as a starting resistance in the secondary circuit of the motor. The whole controller is enclosed in a sheet iron splash-proof case, mounted on a pedestal two feet high.

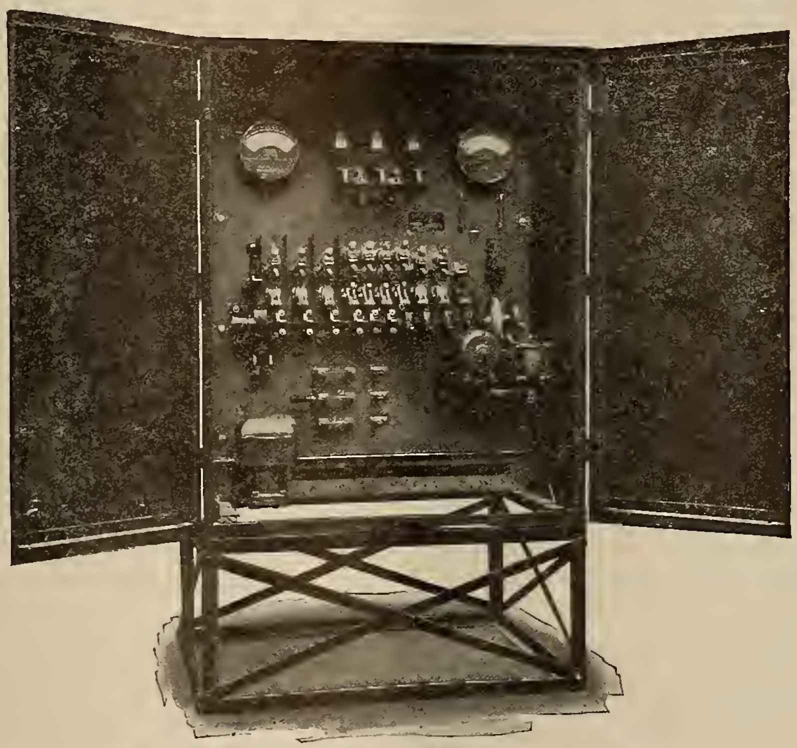
The double-throw knife switch is for transferring the motor from one set of service lines to another, as connection to two separate power lines is often provided for reliability. The starter proper consists of a square shaft above which are mounted the three primary and the six secondary cam operated switches. There is also an auxiliary cam operated switch at the extreme right, the function of which is described below. The cam shaft, which actuates these switches, is revolved for manual operation by a hand lever shown at the extreme left of the shaft.

The manual operation is of primal importance, and it is only necessary for the operator (who may be an inexperienced night watchman) to pull the hand lever from the upper position through 180 degrees to the lower or full running position. The lever is held in the running position by an automatic release coil. The movement of the lever above described first closes the three primary switches simultaneously, and then closes the secondary resistance switches in proper succession, until the motor is brought up to full speed. The secondary switches are so designed that the resistance is cut out of each phase at the same time in equal portions and thus the motor is kept balanced all during the starting period. On failure of voltage or at the will of the operator the switches are all opened, the shaft being returned by a heavy clock spring.

If automatic control can be conveniently incorporated without complication of the hand operation, it gives a satisfactory method for maintaining a constant water pressure when a single sprinkler head opens or when a leak develops in the piping system. Futhermore, the automatic operation provides a safety feature which is not available in a straight hand starter.

As in the hand operation the cam shaft is revolved to start the motor, but the operation in this case is taken care of automatically by a pilot motor mounted on a bracket below the right hand portion of the shaft. This motor drives the shaft through a worm-gear reduction box, the gears running in oil. A solenoid operated clutch is between the reduction gear box and the cam shaft. The automatic starting operation is as follows: When the pressure in the tank or stand pipe falls below a predetermined amount, due to opening of sprinkler heads, leaks, etc., the pressure governor closes the control circuit for a small two-pole magnetic switch located just above the cam shaft at the right hand end. This switch closes and opens the pilot motor circuit. At the same time the governor closes the clutch solenoid circuit. The pilot motor revolves and a spring behind the movable jaw clutch member is compressed by the clutch solenoid. As soon as the jaws match, the spring causes the clutch to engage and the cam shaft is revolved. The three primary switches are closed quickly, due to the shape of their cams. The secondary switches are then closed in succession, cutting resistance out of the motor rotor circuit just as in the case of hand operation. After the last secondary switch is closed the auxiliary cam switch opens and drops out the pilot motor switch, thus stopping the pilot motor and preventing further revolution of the cam shaft. The worm gear reduction prevents the motor revolving backwards, and keeps the switches in the running position with the fire pump motor up to speed.

The clutch solenoid remains in until the pressure in the sprinkler system reaches the required maximum, when the pressure governor opens the circuit to the clutch solenoid, disengaging the clutch. The heavy clock spring returns the cam shaft quickly to the "off" position. The clutch solenoid is therefore the automatic and no-voltage release, because the solenoid when de-energized allows the starter to return to the off position, stopping the motor.



New Cutler-Hammer A.C. Fire Pump Motor Starter.

NEWS NOTES

ILLUMINATION.

FOWLER, CAL.—The trustees have granted A. A. Webber of Los Angeles a permit to install a gas plant here.

ARROYO GRANDE, CAL.—Mr. Fessler, local foreman of the Santa Maria Gas Company, has measured off the most direct route for a pipe line between here and San Luis Obispo, it being the intention of the company to carry the line on to the county seat.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has applied to the railroad commission asking approval of a contract under which it will furnish electricity to the Oro Electric Corporation in variable quantities at prices ranging from 6c to 7c per kw. hour.

SEATTLE, WASH.—A council bill has been introduced by the city utilities committee by which lighting rates for residences and churches will be reduced from 6 to 5½ cents per kw.-hr. for service up to 60 kw.-hr. per month, and to 4 cents for all service of more than that amount.

WINTERS, CAL.—Sealed bids will be received by the clerk of the board of trustees, up to October 7th for the sale of a franchise to use the public streets and alleys of the town of Winters, for the laying of pipes and conduits, for supplying the inhabitants of this town, with a gas lighting system.

PORTLAND, ORE.—Bids will be received by H. R. Albee, commissioner of public safety, until September 24, for the complete installation of electric lighting fixtures for the new city jail on Second and Oak streets. Plans and specifications are on file in the office of the architects, Emil Schacht & Son.

HERMOSA BEACH, CAL.—An ordinance has been adopted by the board of trustees, ordering that ornamental lighting posts, with all appliances, be erected along Thirteenth and Fourteenth streets, also that fibre conduit be constructed therein, according to specifications, plans and requirements of this resolution.

REDLANDS, CAL.—A resolution has been adopted by the Board of Trustees, ordering that 37 cast iron ornamental lighting posts be erected along Central avenue, Fifth, Vine and Fourth streets. All posts are to be equipped with necessary wires, lamps and all other appliances, in accordance with special plans and resolution requirements.

SEATTLE, WASH.—The budget committee of the Seattle city council in considering appropriations for next year, discussed an item of $5000 for the employment of a gas expert to appraise the property of the Seattle Lighting Company and to give testimony as to the amounts to be allowed for overhead charges when the state public service commission holds its hearing on the complaint of the city council that the rates of the company need adjustment. The committee has requested the public utilities committee to ascertain just what amount it would be necessary to pay for the services of an expert.

GRAND JUNCTION, COLO.—A Washington dispatch conveys information that Grand Junction has been granted a preliminary permit for a conduit on the Battlement National Forest. The city proposes to install a municipal hydroelectric plant for the development of light and power. The Grand Junction Electric, Gas & Manufacturing Company, which now furnishes power to the city and the surrounding country, is trying to sell its entire holdings to the city. As this development bears on the federal policy of co-operation with states, counties and municipalities for the common welfare, government officials at Washington express particular interest in it.

TRANSMISSION.

SALEM, ORE.—Surveys have been completed by State Engineer Lewis for a large power project on the Klamath River. According to estimates made, about 100,000 horsepower can be developed by building a canal and tunnel 10.5 miles long. An important problem is the disposition of such power after it is developed.

VANCOUVER ISLAND, B. C.—The Canadian Collieries Company has recently started operating its new $1,500,000, 16,000 horsepower plant on the Puntlidge Lake development. Grant, Smith & Company were general contractors, the electrical equipment was furnished by the Canadian General Electric Company and Escher Wyss Company of Zurich, Switzerland, furnished the waterwheels.

WASHINGTON, D. C.—On September 5th the secretary of agriculture signed a water power permit granting to the Sierra Electric Power Company the right to use for power development certain land within the Lassen national forest, California. The company is organized under the laws of the state of California and has its office and place of business in Oakland. The waterpower project is located on Mill Creek and approximately 25 miles east of the city of Red Bluff in Tehama county. By means of low dams across the creek the flow is to be diverted into a conduit with a capacity of 300 second-feet and a total length of more than 16 miles. At the upper end of the pressure pipes a small regulating reservoir is to be built. By this means, it is hoped to reduce, if not eliminate, a large portion of the water-waste occasioned by hourly fluctuations of the load. In the power house—which is to be built of concrete—there will be installed machinery capable of providing a constant output of 22,500 kilowatts. The electric power will be transmitted to the market at 110,000 volts.

SAN FRANCISCO, CAL.—In accordance with notice given on July 26th the stockholders of the Pacific Gas & Electric Co. met last week and authorized the issuance of a 1-year 6-per-cent note issue of the maximum amount of $7,000,000. This is the note issue which was authorized by the railroad commission on August 11th. The sale of $4,500,000 of this issue to a syndicate of New York bankers has been announced heretofore. The unsold remainder of $2,500,000 will be held in reserve and will not be sold unless it is found necessary. These notes will be secured by $5,000,000 par value, general and refunding 5-per-cent bonds, and $5,000,000 general lien 6-per-cent bonds of the company, both of which issues have already been authorized by the railroad commission. When conditions in the money market become normal these bonds will be sold, and will not only provide sufficient funds for redeeming the notes, but will leave a substantial balance of cash to the company for future improvements. The funds derived from the sale of the $4,500,000 notes are being used by the company in the prosecution of its Lake Spaulding development and for other extensions demanded by the growth of its business.

TRANSPORTATION.

GREAT FALLS, MONT.—A project is on hand to construct a trolley line five and one-half miles from Red Lodge to Washoe. Surveys and estimates by County Engineer Gibson fix the cost of such a line at $50,000.

ALBANY, CAL.—The town of Albany has filed a suit for $5000 damages against the Oakland Traction Company, alleging that the company has failed to comply with the agreement in the franchise to extend and operate lines through Albany.

LOS ANGELES, CAL.—The city council has authorized the city attorney to prepare notice for sale of a franchise applied for by Pacific Electric Company for railway on Maubert avenue, from Sunset and Hollywood boulevards, to Los Feliz road. The franchise is recommended by the public utilities commission.

SAN FRANCISCO, CAL.—The San Francisco & Oakland Terminal Railways Company has applied for an injunction in the United District Court to prohibit the Alameda city council from enforcing its ordinance requiring the corporation to carry school children for half fare only. The corporation alleges that enforcement will impair its franchise, and that it cannot afford to transport children at this rate. A permanent injunction is prayed for, and an order declaring the ordinance illegal.

SAN FRANCISCO, CAL.—The supervisors have passed to print the ordinance providing for the issuance of $3,500,000 of 5-per-cent bonds to provide for the extension of the municipal railway system on Van Ness and Potrero avenues, Stockton, Eleventh, Church, California and other streets. Two accompanying resolutions were adopted, one formally declaring the result of the late bond election, the other requesting the city attorney to solicit offers from the Presidio & Ferries Railway Company for the sale of such of its property to the city as may be useful in the carrying out of the proposed extension plans.

TELEPHONE AND TELEGRAPH.

HAYWARD, CAL.—The city trustees have awarded the contract for the installation of a fire alarm system to the Gamewell Fire Alarm Company for $3985.

PASADENA, CAL.—The Home Telephone Company is planning a new trunk line between South Pasadena and Los Angeles. Two carloads of cable have been received for the line.

MORGAN HILL, CAL.—The trustees have passed an ordinance granting to T. H. Dassel, a franchise to construct and operate a telephone and telegraph service in the town of Morgan Hill, for a period of 50 years.

SAN FRANCISCO, CAL.—At the suggestion of the electricity committee of the supervisors, the board of works and the city engineer's department will consult with the chief of the department of electricity, Wm. J. Nixon, in the preparation of plans for the new fire alarm and police signal station which is to be built in Jefferson Square.

CHANDLER, ARIZ.—W. Clyde Palmer, district sales manager of the Mountain State Telephone & Telegraph Company, states that construction of lines in the Chandler district will start soon preparatory to installing an exchange here. Work is to be completed within 60 days. The lines will extend for a distance of four miles around Chandler and take in all ranches within that radius.

SAN FRANCISCO, CAL.—At the hearing last week before the railroad commission, sitting en banc on the question of telephone toll rates, G. E. McFarland, president of the Pacific Telephone & Telegraph Company, testified that the re-production cost of the company's property within the State of California was approximately $51,000,000, and that the present value of its holdings was probably 85 per cent of that amount. He maintained that, should the commission's proposed rates go into effect, the company would earn only 2.23 per cent on a valuation of $51,000,000, or about $1,250,000, within the state. These figures, he stated, made no provision for the interest charges on the $32,000,000 of 5 per cent bonds outstanding. McFarland testified, relative to the question as to what portion of the extensions had been built out of earnings, that the depreciation reserve of the company on June 30, 1913, was $9,012,999, and of this amount $5,952,416 had been allotted to California, and was now invested in the assets of the company. He further testified that $4,000,000 would be expended on construction work in this state during the present year.

WATERWORKS.

TULARE, CAL.—The firm of Sloan & Robson, engineers, who have charge of the work of installing the new municipal water system have begun work on the distributing system.

HILLYARD, WASH.—The city council of Hillyard passed an ordinance to install four and six inch metal lateral water mains throughout the city at an estimated cost of $91,740.

REDLANDS, CAL.—J. H. Flynn, representing the Southwestern Home Telephone Company, is laying out a telephone system for Yucaipa valley, with a switchboard in the Yucaipa hotel.

MANTECA, CAL.—A Bacilieri is superintending the extension of his water system. Five thousand dollars will be spent in improvements, a pump of larger capacity will be installed and a larger tank built.

SACRAMENTO, CAL.—The city of Sacramento has awarded to C. F. Braun & Company, the contract for a 15,000,000 gallon per day Alberger centrifugal pumping engine unit, the steam turbine and centrifugal pump, replacing a smaller unit of the obsolete reciprocating type. The city will, with this modern unit, be able to pump water into the mains at 50 lb. pressure at a fuel cost of ¼c per 1000 gallons, and will also be able to deliver water for fire-fighting at a pressure of 100 lbs. per square inch.

SAN DIEGO, CAL.—W. G. Henshaw of San Francisco, representing a New York syndicate, has proposed to the city council to develop and supply the city of San Diego, by March 1, 1915, a minimum of 5,000,000 and a maximum of 20,000,000 gallons of San Luis Rey River water at 12c per 1000 gallons, daily. Mayor O'Neill and members of the council express their approval of the project. The project involves $10,000,000 and includes the purchase of Warner's ranch, which will give the syndicate control of 98 per cent of the riparian rights of the San Luis Rey River.

SAN FRANCISCO, CAL.—Spring Valley officials state that the company stands ready to meet the city half way in any suggestions that will result in bringing an adequate supply of water into the city, but that some decisive action must be taken or there will be an absolute want of water in this city by 1915. The city is using 49,000,000 gallons of water daily. This is all the water that can be supplied by the company until the system is enlarged. For two years the winter rains have not met the needs of the city, with the result that the company has been drawing heavily upon the reserve and the reservoirs have been depleted to a point that, with another dry winter, would result in a famine. To meet the situation an additional pipe line, it is contended, should be constructed across San Francisco Bay and a dam built in the Calaveras Valley in Alameda county. This would result in almost doubling the capacity of the Spring Valley system. The pipe line across the bay, it is estimated, will cost between $2,000,000 and $3,000,000. The Calaveras dam will cost between $1,000,000 and $2,000,000. Construction work already has been begun by the water company on the dam. A steam shovel is at work clearing away the gravel in the bed of the stream and a viaduct is being constructed to carry off the winter flow. It is estimated that the dam can be built high enough by the winter of 1914-15 to catch that year's flood and that this could be made available in time for the fair, if the pipe line is built.

ALPHABETICAL INDEX TO ADVERTISERS

All Eyes Turned Toward the West

Within the next few years many people are coming West to live. Already population statistics show that the West is leading the world in increasing population. The world's great exposition at San Francisco will receive as visitors approximately sixty millions of people, many of whom when they see what the West has to offer will return. This increase in population means new homes. Now, what does this mean to you, Mr. Manufacturer, Mr. Jobber, Mr. Supply Man, Mr. Contractor, Mr. Central Station Manager?

Are you considering this big field? Are you trying to make a part of this immense business yours?. Are you represented in the engineering mouthpiece of the West?

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Advertisements of Character

which appear in the Journal carry this authority and confidence with them?

It will pay you to investigate this field before deciding on your 1914 campaign.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

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Boxes and Fittings
Sprague Electric Works
Electric Grills
General Electric Co.
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Weston Electrical Instrument Co.
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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

The term "weatherproof" is in such common use that any wire having a semblance of insulation is called "weatherproof."

"O. K." WEATHERPROOF

is the only *really weatherproof wire.*

The standard with the electrical world for over 20 years

Manufactured in triple braid exclusively, because years of experience in manufacturing insulated wire have demonstrated its superiority as a satisfaction giver.

The first and second braid are thoroughly saturated with dense pitch compound, and applied at high temperature, while the third absorbs any excess compound on the previous layers, and is coated with natural Austrian paraffin wax, ground into the meshes with a permanent highly polished surface given, which sheds rain and moisture.

Only manufacturers following such a two dip process

No hard coated surface to crack and peel or "drifting" of coating to bottom of wire, leaving top insulation exposed to early rot by heat and water. Rough and uneven surfaces which catch moisture, with consequent swelling and shrinking, split, frayed and tattered insulation, eliminated.

Our belief is so strong in the uniformity and strict compliance to weight schedules, finish and durability of

"O. K." WEATHERPROOF WIRE

we guarantee it to you for twenty years.

It will mean economy and efficiency for you to investigate.

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

Distributors for the Pacific Coast

SAN FRANCISCO OAKLAND LOS ANGELES PORTLAND SEATTLE

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI | SAN FRANCISCO, SEPTEMBER 27, 1913 | NUMBER 13

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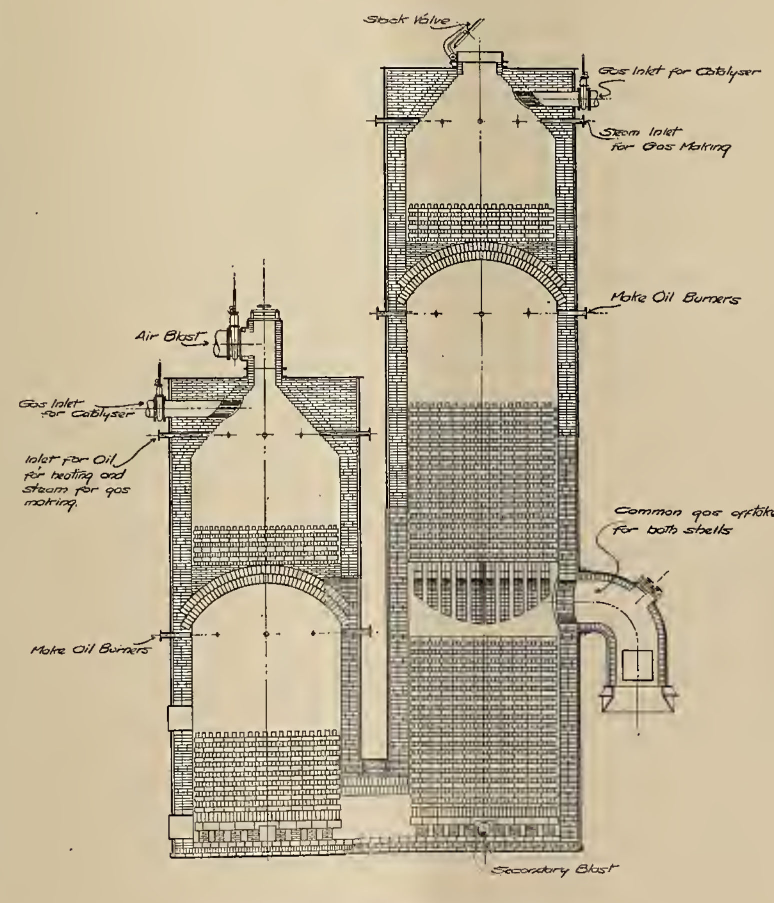
MANUFACTURE OF OIL GAS[1]

BY L. B. JONES.

It is not my intention to attempt to cover the scope suggested by the title of this paper, but merely to review a series of experiments and the resultant developments, carried on in San Francisco in the past few years.

Since 1902 when gas made exclusively from crude oil was first introduced as the supply of a large city until today when oil gas is used to the exclusion of all other methods of production in California, many have doubted the eventual success of this process. But the doubters were not in the ranks of the true oil gas men, the noble pioneers who conceived the idea of the manufacture of gas from crude oil years before the enormous production of crude oil in California made oil gas an economic necessity and those who nursed the infant industry and bravely bore the discouragement of failures and put on a solid running basis, an industry which in the hands of less noble men might easily have been a failure from its inception.

For years the one feature which has prevented oil gas from being an ideal process for gas manufacture has been the large percentage of the rich hydrocarbons of the oil which are dissociated, only the hydrogen portion of which appears in the gas, the carbon being a by-product. The severe treatment of the oil with extremely high heats was the cause of the excessive production of lampblack in the early oil gas and the proportionately poor quality of the gas.



Improved "Jones" Oil Gas Set.

It was not alone the extreme temperature but the lack of uniformity of temperature. The extremely high temperature being in a measure what we might call "false heat" or "surface heat"; that is, the actual temperature existed but its capacity for doing work in the breaking up of the oil was lacking. The extreme temperatures lasted only during the beginning of a run or gas-making period and in the latter part of a run, the temperatures were far below any now utilized for gas making. Were this not so, the efficiency of the early oil gas would have been extremely high, only the quality of the gas being low. Had uniformly high heats been employed, the early oil gas man would have encountered no scrubbing troubles other than the removal of lampblack. Tar would have been an unknown trouble. But this we know was not the case.

The oil used per thousand feet was high, the

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[1]Paper presented at Twenty-first Annual Convention Pacific Coast Gas Association.

quality of the gas was low and tar as well as lampblack represented a large portion of the oil. In each run, a portion of the oil was destroyed by being subjected to temperature far in excess of the bonding point of its hydro-carbons and the remainder was stewed at temperatures below the fixing point of a commercial gas.

It was soon realized that during the run at some intermediate point between the extremes of temperature, the oil was subjected to the proper degree of heat—a treatment that produced not only a good quality of gas but efficient results. But this point was quickly reached and more quickly passed and the results attained were lost in the aggregate. By a process of elimination, we may assume that if one temperature is right for the reforming of the oil, all the rest must be wrong. And from this theory, the striving has been toward the maintaining of a uniform temperature, the treatment of all the oil alike. The greatest mechanical development tending to unify the heat to which the oil is subjected was the improvement of the two shell machine with the gas offtake intermediate of the point of combustion of the oil used for heating the generator and the stack valve. It has been definitely proven not only by experience but by careful tests that the heat of the checker brick or heat reservoirs immediately adjacent to the stack valve and also the point where the initial combustion of the heat oil takes place is "false heat" or "surface heat" and lacks the body and is not the substantial heat which we find in the checker brick in the central portion of the generator. This is due to the fact that when oil is injected into the machine together with a forced blast of air for heating the apparatus, combustion is not immediately complete but the heat of the checker brick is utilized in a gradually lessening degree to convert the oil into a gaseous or more easily combustible state until the combustion is complete. The following three samples of combustion products will show more clearly what I have endeavored to explain:

	CO_2	O_2	N_2
Sample No. 1	14.2	0.0	85.8
Sample No. 2	15.0	0.0	85.0
Sample No. 3	15.4	0.0	84.6

These samples were taken in their order simultaneously at increasing distances from the combustion chamber, the increasing percentage of CO_2 showing the combustion to be more nearly complete some distance from the initial point of combustion.

The reason for the lack of stability of the heat in the checker brick nearest the stack is usually an economic one.

In order to minimize the loss of heat at the stack, the combustion should be regulated so that the maximum liberation of heat is in the central portion of the checker work and the checker work nearest the stack gets only the tail end of the combustion and while the brick attain a considerable temperature, they do not contain any great quantity of heat.

A result of these peculiar combustion conditions is the inverse variation of the temperatures in the two ends of a generator; if the combustion end is excessively hot, the stack end will be proportionately cool. From this fact, the two shell machine with the gas offtake intermediate of the course of combustion in heating, derives its undisputed advantage over all other forms of generators, the natural balance of heat in the two shells maintaining a uniform quality and production of gas at all times.

In the two shell sets where oil is injected with steam into the top chamber of both the long and short shell simultaneously for gas making and the gas offtake is located in the lower half of the long shell, the first temperature to which the oil is subjected is not the maximum temperature. The checker brick in the upper portion of each shell with which the oil first comes in contact do the greatest amount of work and are the regulators which limit the quantity of oil per run, but the temperature of these brick does not constitute the fixing or superheating temperature to which the gas is subjected in the central portion of the long shell near the offtake. While the temperature in the upper portion of the checker brick in each shell to which the oil and steam are first subjected vary several hundred degrees Fahrenheit during a run, the superheating or fixing temperature remains fairly constant.

In the past ten years, the art of manufacturing gas from crude oil has advanced rapidly until today, the modern oil gas is without doubt, the most nearly ideal fuel, being superior in many respects to coal or water gas. The advancement has been not alone in the quality of the gas but equally in the efficiency of production, and oil gas, the infant industry, now compares favorably with the older methods as regards a comparison of production, raw material used and unchanged by-product. The coal gas man is forced to find a market for his by-product while the oil gas man is more fortunate, as he may utilize the carbon by-product for the production of water gas and thus stay exclusively in the gas business. For several years, the large oil gas works have maintained water gas units for utilizing the lampblack and thus practically all of the oil is eventually converted into gas. But this meant the duplication of a great deal of apparatus and duplicate handling of the raw material first as oil, then the separation of the by-product and the handling as water gas fuel. This extra labor is excessively expensive when compared with the ideal oil gas, the production of oil gas without the lampblack by-product.

And it is thus along these lines, the combining into one process what was accomplished in two, that the oil gas engineer has been working.

The first step was a study of the existing conditions in the production of lampblack water gas. To attempt to reproduce in an oil gas set the conditions existing in the generator of a water gas set was apparently hopeless. The extreme temperature of the fuel bed which makes the dissociation of steam and the conversion of most of the carbon to carbon monoxide possible would be disastrous to the hydro-carbons of the oil and as a luminous high heat value gas is still the requirement, the attempt to imitate the generator portion of the apparatus was given up. While the apparatus used in the production of water gas from lampblack is substantially the same as employed when coal is used as the base, certain differences exist in operating conditions. The best results are obtained

with an empty carburetor using no checker work. The temperatures employed are higher and the time of contact proportionately less than when using coal. The same quality of oil is used for enriching in the water gas as is used in the production of oil gas. The carburetor and superheater temperatures are nearly as great as are employed in oil gas and yet no lampblack is produced. Wherein lies the difference? It is a well known fact that certain chemical reactions are entirely different when taking place in an atmosphere of air or in an atmosphere of hydrogen. Certain reactions will only take place or are greatly stimulated by the presence of a catalyser. This catalyser does not enter into the reaction, yet its presence is essential.

The one great difference between conditions in an oil gas set and the conditions in the carburetor of a water gas set is the atmosphere into which the oil is injected.

When the heating period is completed in an oil gas set, the interstices of the brick and the chambers are filled with carbonic acid and nitrogen, the products of combustion from the heat oil and into this inert atmosphere the oil for gas-making is injected. In the water gas carburetor, it is entirely different, the oil is injected into an active atmosphere of carbon monoxide and hydrogen produced in the generator and passing through the carburetor. And this gas is the catalyser which prevents the destruction of the oil and the consequent waste of large quantities of uncombined carbon.

Here was a condition which could be reproduced in the oil gas generators. It was at first thought to attach a small water gas generator to one of the large oil gas sets. This was not practical as our endeavors were to eliminate the lampblack by-product and this would have been our only available solid fuel for the water gas generator.

We next endeavored to produce the desired result by purging one of the 16 ft. Jones sets with steam for a minute before any oil was injected. This was done by admitting all available steam after the blast valve and stack valve were closed and the machine ready to make gas. A portion of this steam was dissociated and recombined with the fine particles of carbon remaining on the brick from the previous heating period, thus forming an active initial atmosphere.

The two following analysis sheets show the results of this test. Gas samples were taken from the primary and secondary shells just above and below the common gas offtake at the end of each consecutive minute. The temperature quantity and quality of oil and all other conditions were as nearly identical as possible in these two runs except that all available steam was turned into the set for one minute previous to the admission of any oil in Run No. 2. A comparison of the two runs shows a marked increase in the quality of the gas in the second run, especially in the first few minutes. The marsh gas and illuminants were greatly increased especially in the primary, and the carbon monoxide of the primary gas was considerably increased. These conditions were not due to any reduction in temperature as the quantity of gas made in the second run was greater than in the first and in both runs, identically the same quantity of oil was used.

Run No. 1.

The following table shows the composition of oil gas made in the primary and secondary shells of generator 3 at the same time. The samples are taken at the end of each consecutive minute for a complete run of 10 minutes at an outlet of the primary just below the offtake and at the secondary just above it:

Minutes.		CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2
1.	Pri.	6.2	.6	6.0	15.4	27.9	17.9	26.0
	Sec.	9.8	4.2	.4	12.8	26.7	35.2	10.9
2.	Pri.	3.4	.6	.8	15.6	54.9	23.9	.8
	Sec.	5.4	5.4	.4	9.6	39.6	36.8	2.8
3.	Pri.	2.6	1.2	.6	14.6	48.6	27.0	5.4
	Sec.	4.0	6.0	.6	8.2	33.0	43.3	4.9
4.	Pri.	2.2	1.2	.6	14.6	48.9	28.1	4.4
	Sec.	3.2	6.8	Tr.	7.4	39.5	41.3	1.8
5.	Pri.	2.2	2.0	.2	13.8	50.9	28.6	2.3
	Sec.	2.6	6.8	.2	7.4	37.8	41.5	3.7
6.	Pri.	2.0	2.0	.4	13.4	49.3	28.8	4.1
	Sec.	2.2	8.0	.4	6.0	38.9	41.7	2.8
7.	Pri.	2.0	2.0	.6	13.6	51.4	28.8	2.8
	Sec.	2.0	7.8	.2	6.6	38.9	41.7	2.8
8.	Pri.	4.6	1.0	.2	16.2	62.4	13.0	2.6
	Sec.	2.2	8.0	1.0	6.0	42.3	38.6	1.9
9.	Pri.	7.2	.4	.2	14.6	68.1	6.4	3.1
	Sec.	3.8	6.8	.6	8.2	47.6	30.2	2.8
10.	Pri.	7.6	1.2	.2	12.6	74.1	4.0	.3
	Sec.	5.4	5.6	.2	10.4	52.3	22.2	3.9

Run No. 2.

The following table shows the composition of oil gas made in the primary and secondary at the same time. The samples were taken at the end of each consecutive minute for a run of 11 minutes at the outlet of the primary below the offtake and at the secondary above the offtake. During the first minute of the run no oil was used, but all the available steam was turned on in both shells:

Minutes.		CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2
2.	Pri.	7.0	1.4	.6	18.2	40.8	31.5	.5
	Sec.	3.0	4.6	.8	7.2	39.4	40.8	4.2
3.	Pri.	4.2	2.4	.4	15.8	41.2	32.2	3.8
	Sec.	2.8	6.0	.4	6.2	41.7	41.3	2.4
4.	Pri.	2.8	3.0	.4	13.8	45.3	33.3	1.4
	Sec.	2.2	6.0	.4	6.0	44.6	39.8	1.0
5.	Pri.	2.4	3.4	.2	13.0	45.9	32.4	2.7
	Sec.	1.8	7.0	.4	5.6	44.0	40.4	.8
6.	Pri.	2.4	3.2	.4	11.6	42.1	37.1	3.2
	Sec.	1.6	7.4	.4	5.4	43.5	41.1	.6
7.	Pri.	1.6	3.0	1.0	10.2	46.8	36.4	1.0
	Sec.	1.0	10.0	.6	4.4	37.2	43.4	3.4
8.	Pri.	2.2	3.2	.6	10.2	38.2	40.5	5.1
	Sec.	1.0	8.8	.8	4.0	45.9	36.6	2.9
9.	Pri.	1.6	2.6	1.0	10.4	47.8	33.8	2.8
	Sec.	5.4	2.4	.8	12.2	70.4	7.9	.9
10.	Pri.	3.6	2.6	.8	14.0	50.9	22.4	5.7
	Sec.	8.0	2.4	.6	13.4	63.8	7.6	4.2
11.	Pri.	5.2	1.2	.8	15.4	60.2	14.2	3.0
	Sec.	9.0	1.4	1.0	12.2	66.2	6.4	3.8

The initial atmosphere produced by the dissociation of the steam in the first minute benefited materially the gas produced in the first few minutes of the run. To produce the desired results, it is not sufficient to commence the destructive distillation of the oil in an initial atmosphere of an active gas or gases but to continue in an atmosphere other than the gas produced by the machine from minute to minute. Natural gas under pressure would be ideal for the production of this catalytic atmosphere but as no natural gas is available at the present time in San Francisco, our own oil gas scrubbed, purified and ready for distribution proved the best substitute. And it is this gas that is used today in the improved oil gas process. The idea of putting a finished saleable gas from the storage holders back into the generators may seem queer to say the least, but I will endeavor to prove that it is not queer but quite the proper thing to do.

At this stage of our experiments, the Metropolitan Company was acquired. The major portion of

their generating equipment consisted of two oil gas units. These were two shell sets, both shells 15 ft. in diameter by 39 ft. high connected at the bottom by a large rectangular throat piece. Each shell was equipped with a stack valve and gas offtake at the top and heat burners at the bottom. The oil for gas making was injected at the top of one shell passing downward through the neck and up the second shell. Each alternate run, the direction was reversed. The small capacity of these sets in comparison to their size made a reconstruction necessary. The rebricking and re-arrangement of these sets was an ideal opportunity partially to test the ideas of the new process.

In our estimation, the apparatus for the best results from this new process would be a two shell set, a long and a short shell connected at the bottom by an ample throat piece, the top of the short shell being the blast inlet and the top of the long shell the stack valve, the common gas offtake located on the side of the long shell intermediate of its ends. The bricking and checker work to be so arranged as to form double chambers in the upper end of each shell. Short piers in the bottom of each shell support the main checker work up about two-thirds of the height of the short shell and three-fourths the height of the long shell. At this point, open arches are sprung across the shell forming the tops of the lower chambers and supporting the upper sets of checker work. About twelve courses of checker work rest on each of these arches and the top of this checker and the corbel work forms the top chamber of each shell.

Into the top chamber of the primary or short shell extend the oil burners for heating the apparatus connected to coils of pipe circling the shell. In the same manner, the injectors for admitting oil for gas making are connected into the lower primary chamber and the lower secondary chamber. To the top chambers of each shell are connected gas lines for the admission of gas under pressure for producing the catalytic atmosphere. This supply is regulated by valves controlled from the operating floor. Into these top chambers also are steam connections for supplying steam for gas making and also for purging. After the machine is properly heated and ready for a gas making period, the stack valve and blast valve are closed and the gas and steam under pressure are admitted into the top chambers of each shell.

The illustration on the first page more clearly shows the idea.

During the first minute, no oil is admitted and all the products of combustion from the previous heating period are purged from the machine. Thus at the end of the first minute when oil is admitted into the lower chambers of each shell, it comes in contact with an active atmosphere of gas and steam highly superheated by passing through the upper section of checker brick. The decomposition or destructive distillation of the oil therefore begins and is continued in an active atmosphere and when the excess carbon is freed from the reforming of the hydro-carbons, it is surrounded by steam in a highly superheated condition ideal for dissociation and combination with this carbon. It has long been the practice to admit the oil and steam for gas making together.

This practice to a large degree accounts for the variable temperatures to which the oil is subjected during the run. While the heat absorbed by the steam actually converted into gas is proportionately small, the heat absorbed by the total steam used including the steam used to purge the machine after the run, is a large factor in the total heat absorption. In a thousand cubic feet of average oil gas, the steam actually converted in its production based on the oxygen content seldom exceeds 6 lbs., while the actual steam used for injecting the oil is seldom less than 16 lbs., and the steam used to purge the machine in the last three minutes increases this amount to nearly 27 lbs. per M. cubic feet. These figures are based on actual running conditions, tests showing that during a ten minute run in which 2300 lbs. of oil was injected in the first seven minutes of the run and the production was 40,000 cu. ft., the steam meter showed a consumption of 5700 lbs. per hour, or 665 lbs. of steam during the run and the steam used during the purge to be 8000 lbs. per hour or 400 lbs. during the purge. The heat, therefore, absorbed by the steam during the first seven minutes was 14 per cent of the total heat absorbed and during the entire run including the purge, the steam is accountable for 19 per cent of the total heat loss or reduction in temparature. (These figures based on a specific heat of .6 for oil .305 for steam). It is not the loss of this heat from the standpoint of monetary value of the added heat oil to regain this loss of temperature which constitutes the error of this practice but it is not giving the oil a square deal. The oil is continually being subjected to a decreasing temperature and as the duration of the run must be sufficient to keep up the capacity and efficiency of the machine, the initial temperature must be above or the final temperature below that temperature which will produce both quality in gas and efficiency in results. The top chambers in the apparatus of the new process eliminate this fault to a great extent, the heat of the lower chambers being used exclusively for the breaking up of the oil while the steam and gas are superheated to the temperature of the apparatus by the brick in the upper portion of the machine before entering the gas making chambers. Thus where the reformation of the hydro-carbons leaves an excess of carbon in a free state, steam in a highly superheated condition is immediately present for combination. To entirely exclude steam except under a high degree of superheat from the gas making chambers, gas under high pressure is utilized for injecting the make oil. In some works where high pressure gas is not available, the cost of compression for this use alone might prove excessive. In that case, the steam on the injectors may be reduced to a minimum, the major portion being admitted in the upper chambers.

The addition of the top chambers and checker brick above the gas making chambers is a marked improvement in itself. Besides superheating the steam and gas, these chambers are the means of obtaining a uniform substantial heat in the lower portion of each

shell as any sharp surface heat due to combustion effects the upper sections of brick which are not utilized for the distillation of the oil.

Another material benefit is the use of large chambers between the top of the checker work and the oil injectors thus permitting the oil to be partially broken up or at least vaporized by radiated heat before coming in direct contact with the brick. This is not only a benefit to the oil and brick but permits the heat of a greater number of the brick to be utilized before the temperature of the top portion of brick is reduced below a gas making temperature. The practice of the early oil gas man of attempting to fill all the space within his machine with checker brick accounts for considerable of the carbon accumulation which caused frequent shut downs and many hours of blasting to burn out. This was caused by injecting the oil directly onto the top courses of the checker brick. These brick soon lost the greater portion of their heat and only the lighter portion of the oil was vaporized, the heavier portion accumulating as solid masses of carbon. Another factor greatly affecting not only the condition of the machine but the efficiency of the results and quality of the gas are the injectors or means of introducing the oil into the generators. This subject was the basis of a series of recent experiments, and various types and means of admitting oil were thoroughly tested. Many styles of vaporizers or injectors have been used with varying degrees of success but in every case, the vaporizer is located just inside the coil and vaporized oil and steam are conveyed to the machine through pieces of pipe extending through the lining. The result of these tests showed that the greatest fault was not the vaporizer proper but the means of conveying or the treatment after vaporization.

After testing many various types of vaporizers, it was found that most of them gave an almost perfect oil fog at the tip or outlet when the steam pressure was maintained about 5 lbs. more than the oil pressure.

When sections of ¾ in. pipe such as are used to convey the oil through the lining were screwed onto these burners, a large portion of this oil fog was condensed. Various sizes and lengths of pipe were then tried. The length made no material difference but the only size with which efficient results were attained was found to exactly conform to the size of the end of the tip in the ejector. It also worked equally well with ¾ in. pipe or even larger if the end or tip was reduced to an orifice to conform to the area of the ejector. The best results with the ejector of the Hayden and Derby type, most commonly used was with ¾ in. pipe capped with a ¾ to ¼ in. reducer through which a ½ in. drill had been previously run to remove the threads. Apparently therefore, the one essential requirement in injecting oil is to maintain the velocity after vaporizing until the oil reaches the machine.

While the basic principals of the destructive distillation of oil and the temperature conditions existing within the machines have been the subject of first importance and greatest thought, the lesser refinements and mechanical improvements have all aided materially in obtaining better results.

In speaking of the effect of various temperatures on certain oils and the resultant gas reference is only made to the quality of the heat. The quantity of heat or time to which the oil or gas is subjected to any temperature is a factor which has been entirely overlooked in oil gas practice. The quantity of heat or time of contact is of as great importance as the temperature or quality, for upon the one depends the effectiveness of the other. Many conditions affect the time of contact factor, the area and length of the machine, the number and arrangement of the checker brick and the rate of production of the generator. These factors constitute the velocity of the gas. Widely different results may be obtained when the same temperature is utilized for oil gas making and the velocity or time of contact varies. Likewise similar results may be obtained when the temperature varies within certain ranges and the velocity is increased or decreased to suit. To produce similar results, an increase in temperature requires an increase in velocity or decrease in time of contact. The temperature to a certain extent influences the velocity and to this reason may be attributed the fact that its importance was not sooner realized. If a machine is excessively hot, a larger quantity of gas is produced, the velocity is increased, and therefore it is subjected to the heat for a shorter period of time. The expansion of the gas due to temperature also tends to maintain a balance between the temperature and velocity, but as there is no proportionate relation between temperature and time of contact, both factors must be considered.

In order to demonstrate the effect of velocity or time of contact on the gas, five runs were made on the No. 4 set at the Metropolitan Works. At the time this set was rebuilt, it was deemed advisable to more fully test the new method before making any radical changes. As the two shells of this set were of the same length, only the primary shell was equipped with the upper chamber and double set of checker brick with the idea of adding the upper chamber to the secondary at some future time, should the tests be successful. This set is only mechanically complete in one shell, in all other respects it is all that could be desired for testing the ideas of this new method. In the five runs referred to, it was endeavored to maintain all conditions other than the time of contact or velocity the same. This was accomplished by increasing the duration of each run. The first run was of ten minutes' duration; the second, eleven; the third, twelve; the fourth, thirteen; and the fifth, fourteen minutes. In each run, the first minute was devoted to purging with gas and the last three minutes to purging with steam. Thus only the time required to introduce the oil was increased and in each run practically the same amount of oil was used.

At the end of each minute, gas samples were taken at the wash box, temperature and oil readings were taken and the gas measured in the relief holder. The purge gas used was measured by a station meter.

The following tables give the analysis and quantity of gas made in each minute of each run and all the conditions affecting the runs. The average analyses for the run are based on the analysis and make of each minute.

Averge Analysis of 10, 11, 12, 13 and 14 Minute Runs, No. 4 Metropolitan Set, August 2-7, 1913. Velocity Test.

Run.	Net Make.	Total Oil per M.	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	B.t.u.
10 minute	36715	8.6	3.0	6.1	0.0	7.3	43.7	35.6	4.3	679
11 minute	39609	8.5	3.1	7.1	Tr.	6.2	41.2	37.4	5.0	706
12 minute	39361	8.47	3.6	6.6	0.0	5.1	39.3	38.2	7.2	695
13 minute	39158	8.53	3.1	7.6	Tr.	6.0	40.8	38.0	4.5	721
14 minute	40204	8.6	3.2	6.6	0.0	6.1	42.2	37.5	4.4	700

Run No. 1, No. 4 Jones Set, Metropolitan, 11.00 a. m., Aug. 2, 1913 (10 Minute.)

							Degrees Fahrenheit.		
Minutes.	Gross Make.	Purge Gas.	Net Make.	Prim. Oil.	Sec. Oil.	Total Oil.	Prim. Temp.	Sec. Temp.	Neck Temp.
0.							1610	1460	1670
1.	1576	800	776				1580	1400	1670
2.	4202	800	3402	15.5	14.5	30.0	1550	1310	1680
3.	6531	700	5831	25.2	25.2	50.4	1520	1210	1670
4.	6531	700	5831	21.5	23.3	44.8	1510	1180	1670
5.	5914	800	5114	21.4	22.4	43.8	1490	1150	1670
6.	5892	800	5092	20.5	23.3	43.8	1480	1120	1660
7.	5366	800	4566	15.7	20.3	36.0	1480	1100	1660
8.	4133	200	3933	10.9	10.0	20.9	1480	1110	1660
9.	1553		1553				1480	1130	1650
10.	617		617				1480	1160	1650
	42315	5600	36715	130.7	139.0	269.7			

Make Oil......269.7 =7.34 Gals. per M.
Heat Oil....... 46.7 =1.26 Gals. per M.

Total Oil......316.4 Gals. =8.60 Gals. per M.

Net Gas Made.36715 Cu. ft.

Annlysis Sheet, Run No. 1, No. 4 Jones Set, Metropolitan, 11 a.m. Aug. 2, 1913. (10 Minute.)

Minutes.	Net Make	CO_2	C_nH_{2n}.	O_2	CO	H_2	CH_4	N_2	Sp. Gr.	B.t.u.
1.	776	23.2	.3	0.0	9.5	5.2	18.4	43.4	.975	258
2.	3402	3.3	4.9	0.0	8.4	43.1	36.1	4.2	.451	665
3.	5831	1.8	5.5	0.0	6.7	44.4	38.0	3.6	.422	694
4.	5831	1.5	6.1	0.0	6.0	43.2	39.6	3.6	.425	717
5.	5114	1.4	7.0	0.0	5.6	42.1	40.1	3.8	.432	734
6.	5092	1.3	7.8	0.0	4.9	41.6	40.9	3.5	.433	755
7.	4566	1.3	8.1	0.0	4.8	40.5	41.5	3.8	.441	762
8.	3933	4.1	5.8	0.0	11.3	50.4	25.6	2.8	.433	603
9.	1553	11.0	2.0	0.0	17.0	61.1	8.2	0.7	.428	396
10.	617	13.0	1.6	0.0	16.9	59.4	6.9	2.2	.478	369
Total.	36715									
Av. analysis..		3.0	6.1	0.0	7.3	43.7	35.6	4.3	.444	679

Run No. 2, No. 4 Jones Set, Metropolitan, 11:20 a. m., Aug. 2, 1913, (11 Minute.)

							Degrees Fahrenheit.		
Minutes.	Gross Make.	Purge Gas.	Net Make.	Prim. Oil.	Sec. Oil.	Total Oil.	Prim. Temp.	Sec. Temp.	Neck Temp.
1.							1580	1370	1680
1.	1419	800	619				1590	1370	1680
2.	2580	800	1780	19.6	21.5	41.1	1560	1320	1670
3.	5640	700	4940	16.8	23.3	40.1	1550	1210	1670
4.	6280	700	5580	20.5	24.3	44.8	1530	1150	1670
5.	6028	800	5228	19.6	19.6	39.2	1500	1120	1670
6.	5572	700	4872	15.8	22.4	38.2	1500	1100	1660
7.	5317	700	4617	19.6	24.2	43.8	1490	1080	1660
8.	5707	800	4907	18.6	24.2	42.8	1480	1060	1650
9.	4561	300	4261				1480	1060	1650
10.	2024		2024				1480	1080	1650
11.	781		781				1480	1100	1650
	45909	6300	39609	130.5	159.5	290.0			

Make Oil......290.0 =7.3 Gals. per M.
Heat Oil....... 46.7 =1.2 Gals. per M.

Total Oil......336.9 Gals. =8.50 Gals. per M.

Net Gas Made..39609 Cu. ft.

Anniysis Sheet, Run No. 2, No 4Jones Set, Metropolitaa 11:20 a.m., Aug. 2, 1913, (11 Minute.)

Minutes.	Net Make	CO_2	C_nH_{2n}.	O_2	CO	H_2	CH_4	N_2	Sp. Gr.	B.t.u.
1.	619	20.3	0.0	1.0	5.7	No expl'sn.		73.0	1.082	20
2.	1780	9.0	3.0	0.0	15.0	45.0	24.3	3.7	.514	526
3.	4940	3.0	6.0	0.0	7.0	41.1	37.8	5.1	.459	691
4.	5580	2.0	7.0	0.0	5.0	42.1	40.1	3.8	.434	732
5.	5228	1.5	7.0	0.0	5.5	41.1	40.9	4.0	.438	739
6.	4872	1.7	7.6	0.0	4.7	41.1	40.9	4.0	.439	748
7.	4617	1.7	9.1	0.0	4.2	38.7	42.5	3.8	.453	785
8.	4907	1.7	9.3	0.0	4.0	38.3	43.2	3.5	.453	795
9.	4261	2.0	9.0	0.0	5.0	42.9	37.8	3.3	.437	750
10.	2024	8.2	3.8	0.0	14.0	51.8	18.5	3.7	.472	501
11.	781	12.8	1.6	0.0	15.7	57.5	9.3	3.1	.485	384
Total.	39609									
Av. analysis .		3.1	7.1	Tr.	6.2	41.2	37.4	5.0	.460	706

The increase in time of contact by the increase in duration of the run from ten to eleven minutes shows a marked increase in the quality of the gas.

The illuminants were increased 1 per cent, the methane 1.8 per cent, the hydrogen was decreased and the heating value increased by 27 B.t.u's. The increase from six to seven minutes (in which time the oil was injected), would constitute an increase in time of contact of 16 per cent, but as 8 per cent more gas was made in the eleven minute run, the actual increase amounts to only 8 per cent.

Run No. 3, No. 4 Jones Set, Metropolitan, 11:40 a.m., Aug, 2, 1913. (12 Minute.)

							Degrees Fahrenheit.		
Minutes.	Gross Make.	Purge Gas.	Net Make.	Prim. Oil.	Sec. Oil.	Total Oil.	Prim. Temp.	Sec. Temp.	Neck Temp.
0.							1620	1390	1680
1.	1244	600	644				1590	1350	1680
2.	1561	700	861	16.8	19.4	36.2	1570	1300	1680
3.	4878	700	4178	14.0	18.7	32.7	1560	1190	1670
4.	5463	700	4763	19.6	18.6	38.2	1550	1130	1670
5.	5512	700	4812	17.7	18.6	36.3	1530	1100	1670
6.	4976	700	4276	14.0	19.6	33.6	1520	1080	1660
7.	4927	700	4227	14.0	19.6	33.6	1520	1050	1660
8.	4951	700	4251	16.8	21.4	38.2	1510	1040	1650
9.	5098	700	4398	17.7	21.4	39.1	1500	1020	1650
10.	4146		4146				1510	1020	1650
11.	1927		1927				1510	1040	1640
12.	878		878				1500	1080	1640
	45561	6200	39361	130.6	157.3	287.9			

Make Oil......287.9 =7.30 Gals. per M.
Heat Oil....... 45.8 =1.17 Gals. per M.

Total Oil......333.7 Gals. =8.47 Gals. per M.

Net Gas Made..39361 Cu. ft.

Analysis Sheet, No. 4, Jones Set, Metropolitan, Aug. 2, 1913. (12 Minute.)

Minutes.	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	Sp. Gr.	B.t.u.
1.	16.0	0.0	0.0	0.0	Gas would not explode,		84.0	1.059	000
2.	20.0	1.0	0.0	12.0	22.7	23.5	20.8	.780	380
3.	6.4	4.0	0.0	10.6	37.3	34.9	6.8	.525	618
4.	4.0	5.0	0.0	7.4	41.8	36.2	5.6	.535	657
5.	1.7	6.4	0.0	4.5	42.8	40.1	4.5	.428	721
6.	1.7	7.3	0.0	4.4	40.4	40.4	5.8	.447	733
7.	2.0	7.8	0.0	4.2	39.6	41.6	4.8	.452	752
8.	1.8	8.4	0.0	2.8	37.2	43.5	6.3	.464	772
9.	1.6	8.6	0.0	2.8	37.7	43.5	5.8	.459	778
10.	1.6	8.9	0.0	2.2	39.7	42.9	4.7	.443	782
11.	6.0	5.7	0.0	9.7	46.7	26.2	5.7	.474	589
12.	10.8	2.6	0.0	13.6	54.3	13.4	5.3	.496	451
Average.	3.6	6.6	0.0	5.1	39.3	38.2	7.2	.477	695

Run No. 4, No 4 Jones Set, Metropolitan, 11:20 a.m., Aug. 7, 1913. (13 Minute.)

							Degrees Fahrenheit.		
Minutes.	Gross Make.	Purge Gas.	Net Make.	Prim. Oil.	Sec. Oil.	Total Oil.	Prim. Temp.	Sec. Temp.	Neck Temp.
0.							1670	1610	1680
1.	1370	700	670				1640	1600	1680
2.	2215	800	1415			11.2	1620	1590	1680
3.	3906	800	3106	11.4	13.9	25.3	1610	1580	1670
4.	4453	800	3653	13.5	16.4	29.9	1600	1590	1670
5.	4864	800	4064	15.2	18.4	33.6	1590	1590	1670
6.	5343	700	4643	17.2	21.0	38.2	1550	1600	1670
7.	5846	800	5046	19.4	23.5	42.9	1520	1600	1670
8.	5206	700	4506	18.0	21.9	39.9	1500	1600	1670
9.	5024	800	4224	16.9	20.4	37.3	1500	1600	1670
10.	4156	800	3356	13.6	16.6	30.2	1490	1600	1660
11.	3151	800	2351				1500	1560	1660
12.	1530		1530				1510	1530	1660
13.	594		594				1510	1520	1650
	47658	8500	39158	130.5	158.0	288.5			

Make Oil......288.5 =7.37 Gals. per M.
Heat Oil....... 45.8 =1.16 Gals. per M.

Total Oil......334.3 Gals. =8.53 Gals per M.
Net Gas Made..39158 Cu. ft.

Analysis Sheet, No. 4 Jones Set, Metropolitan, 11:20 a.m., Aug. 7, 1913. (13 Minute.)

Minutes.	Net Make	CO_2	C_nH_{2n}.	O_2	CO	H_2	CH_4	N_2	Sp. Gr.	B.t.u.
1.	670	22.2	0.4	0.6	8.8	9.8	17.0	41.2	.852	87
2.	1415	7.5	4.1	0.0	11.4	39.3	32.1	5.6	.525	601
3.	3106	4.5	4.5	0.0	9.4	43.5	33.3	4.8	.466	629
4.	3653	3.4	5.0	0.0	7.6	44.8	35.7	3.5	.438	663
5.	4064	2.4	6.6	0.0	6.0	45.3	36.8	2.9	.422	704
6.	4643	1.8	7.8	0.0	4.6	42.0	40.0	3.8	.436	747
7.	5046	1.6	8.6	0.0	3.8	41.6	41.6	2.8	.422	774
8.	4506	1.7	9.4	0.0	3.7	38.3	43.3	3.6	.455	797
9.	4224	1.9	9.7	0.0	4.0	35.2	45.0	4.2	.477	812
10.	3356	2.0	9.2	0.0	4.6	37.9	42.1	4.2	.465	781
11.	2351	3.0	7.5	0.0	7.5	39.2	36.9	5.9	.480	707
12.	1530	5.2	6.0	0.0	9.4	45.0	29.1	5.3	.473	619
13.	594	12.4	1.6	0.0	14.3	57.8	9.0	4.9	.481	337
Total.	39158									
Av. analysis.		3.1	7.6	Tr.	6.0	40.8	38.0	4.5	.462	721

Run No. 5, No. 4 Jones Set, Metropolitan, 11:40 a. m., Aug. 7, 1913. (14 Minute.)

Minutes.	Gross Make.	Purge Gas.	Net Make.	Prim. Oil.	Sec. Oil.	Total Oil.	Prim. Temp. (Degrees Fahrenheit)	Sec. Temp.	Neck Temp.
0.							1700	1620	1690
1.	1233	700	533				1660	1600	1690
2.	1416	700	716	2.7	3.3	6.0	1640	1590	1690
3.	4658	600	4058	14.3	17.4	31.7	1620	1570	1680
4.	3707	700	3007	11.0	13.3	24.3	1610	1560	1680
5.	4098	700	3398	12.6	15.4	28.0	1600	1560	1680
6.	5171	700	4471	16.8	20.5	37.3	1560	1570	1680
7.	5098	700	4398	15.2	18.4	33.6	1550	1560	1670
8.	4146	600	3536	11.3	13.8	25.1	1560	1560	1670
9.	3610	700	2910	9.7	11.7	21.4	1550	1550	1670
10.	3658	700	2958	11.8	14.3	26.1	1550	1550	1670
11.	4414	700	3714	15.1	18.4	33.5	1520	1550	1670
12.	4524	700	3824	9.9	12.1	22.0	1510	1560	1660
13.	1901		1901				1520	1480	1650
14.	780		780				1520	1480	1650
	48404	8200	40204	130.5	158.5	289.0			

Make Oil......289.0 = 7.2 Gals. per M.
Heat Oil....... 45.8 = 1.13 Gals. per M.

Total Oil......334.8 Gals. = 8.33 Gals. per M.

Net Gas Made..40204 Cu. ft.

Analysis Sheet, No. 4 Jones Set, Metropolitan, 11:40 a. m., Aug. 7, 1913. (14 Minute.)

Minutes.	Net Make	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	Sp. Gr.	B.t.u.
1.	533	22.0	0.0	0.0	7.6	9.8	15.3	45.3	.940	224
2.	716	18.8	1.0	0.0	11.2	26.5	22.4	20.1	.743	389
3.	4058	4.0	4.8	0.0	8.6	40.4	37.2	5.0	.473	663
4.	3007	3.2	5.8	0.0	7.0	44.3	36.4	3.3	.437	683
5.	3398	3.0	6.2	0.0	6.4	44.1	36.6	3.7	.438	691
6.	4471	1.6	6.4	0.0	4.4	43.3	40.9	3.4	.421	731
7.	4398	1.6	7.6	0.0	4.2	41.4	41.9	3.3	.431	759
8.	3536	2.0	8.8	9.0	4.6	41.4	40.2	3.0	.442	767
9.	2910	2.6	6.7	0.0	6.1	44.2	37.4	3.0	.431	708
10.	2958	2.2	7.3	0.0	5.1	40.8	40.6	4.0	.447	740
11.	3714	1.8	8.0	0.0	4.2	39.6	42.3	4.1	.447	764
12.	3824	1.8	8.2	0.0	3.6	39.4	42.5	4.5	.448	768
13.	1901	6.9	4.3	0.0	15.0	57.4	15.4	1.0	.427	499
14.	780	8.8	3.5	0.0	15.3	59.9	12.1	.4	.429	458
Total.	40204									
Av. analysis.		3.2	6.6	0.0	6.1	42.2	37.5	4.4	.452	700

Drop in Purge Gas in 3d minute affected 4th minute's gas.
Drop in Purge Gas in 8th minute affected 9th minute's gas.

A slight increase in methane is counteracted by a decrease in illuminants in the twelfth minute and from then, the methane decreases and the hydrogen increases with an increase in time of contact. Very little benefit is derived by the increase after eleven or possibly twelve minutes and the velocity of the gas in the eleventh minute might be considered as proper in proportion to the temperature for this machine.

The time of contact should be regulated in the construction of the generator by the length of shell or arrangement of checker work as any increase in length of run decreases the daily capacity of the machine. The practice of forcing machines to their fullest capacity is common to the oil gas man. Every machine has a capacity where efficiency and quality of gas may be combined and if the machine is forced, one or the other is sacrificed. When these tests were first undertaken with the idea of converting a greater percentage of the carbon of the oil into gas, it was the belief that this carbon would combine with the steam used and appear in the gas as carbon monoxide.

While the gas made by the new method embraces a larger part of the carbon of the oil, the carbon monoxide content is lower than in the gas made the usual way. The conditions for the production of carbon monoxide are equally as good and in fact superior. The temperature is sufficient, as a large quantity of carbon monoxide is produced in the last three minutes of the run after the oil is shut off. In fact, there is no good reason to believe that carbon monoxide is not formed. This leads to the belief that it is formed and combined after formation. We are thus forced to consider the production of methane or marsh gas synthetically.

Several years ago, such a suggestion would have been tabooed, but since the experiments of eminent chemists have proven the theory and have produced methane or marsh gas synthetically, we must seriously consider its production on a practical scale. A great many of the experiments conducted by these chemists in the production of synthetic marsh gas have been in conjunction with a study of catalysis and in this

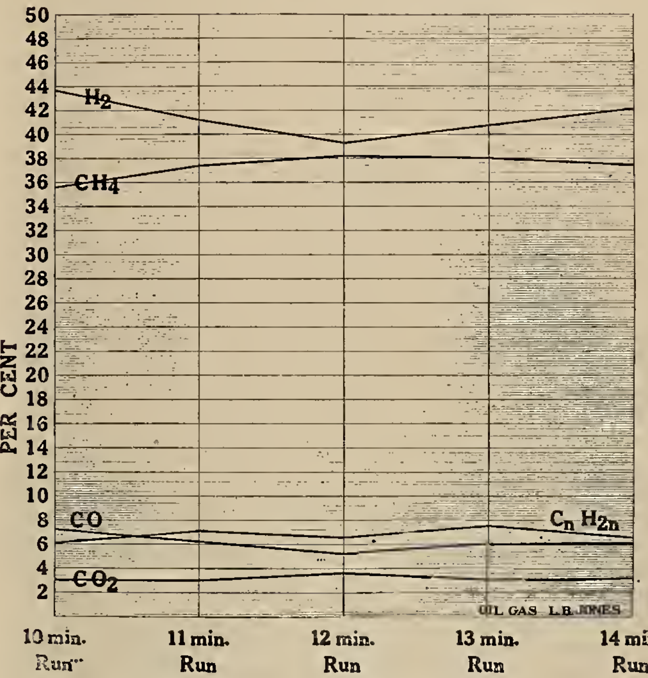


Chart Showing Effect of Velocity on Quality of Gas.

respect, our experiments of a highly practical order have paralleled those theoretical or laboratory experiments. In Bulletin 7 of the Department of the Interior, the authors quote the experiments of Mayer, Henseling and V. Altmeyer as described in the German Journal of Gas Lighting, Vol. 52

In view of the fact that at the temperature employed in the velocity tests described, the formation of carbon dioxide from steam and carbon and the reaction from carbon dioxide to carbon monoxide is very sluggish, all reasoning would lead to the conclusion that an increase in the time of contact in the runs in which the velocity was decreased would produce a greater percentage of carbon dioxide and carbon monoxide.

In all probability, this ts true, and more carbon monoxide was produced, but was utilized for the production of synthetic marsh gas. There are several equations which might be followed in the eventual conversion of carbon and steam into marsh gas, but from the ratio of the constituents of the gas, the probable equation is as follows:

$$2H_2O + C = 2H_2 + CO_2$$
$$CO_2 + C = 2CO$$
$$2CO + 4H_2 = 2CH_4 + O_2$$
$$O_2 + C = CO_2$$

It has always been the theory that marsh gas was purely the result of destructive distillation of the oil and this is undoubtedly true of the larger portion appearing in the gas, but the exceptionally large quan-

tity of marsh gas in the gas of the new process upholds the theory of its production synthetically.

From the foregoing reaction, an increase in marsh gas would be accompanied by an equal decrease in carbon monoxide and an increase of one-half as much carbon dioxide and a decrease of twice as much hydrogen. Reference to the average analyses of the runs of the velocity test shows this to be true.

A comparison of the ten-minute run with the twelve-minute run shows

Increase in marsh gas	2.6%
Decrease in carbon monoxide	2.2%
Decrease in hydrogen	4.4%
Increase in carbon dioxide	.6%

Comparing the ten with the eleven-minute run shows

Increase in marsh gas	1.8%
Decrease in carbon monoxide	1.1%
Decrease in hydrogen	2.5%
Increase in carbon dioxide	.1%

In order to prove beyond the possibility of doubt that marsh gas is being produced synthetically, it would be necessary to have the hydrogen content of the illuminants and marsh gas combined greater than the hydrogen content of the oil. Such proof would be indisputable, but such a gas has not to my knowledge been produced. However, it is reasonable to suppose that as the carbon and hydrogen are linked in the oil, the destructive distillation of the oil resulting in the liberation of carbon in a free state also results in the liberation of some hydrogen in a free state. This is undoubtedly true, as the hydrogen from steam based on the oxygen content seldom exceeds 35% of the free hydrogen of the gas.

Upon this theory that the uncombined carbon or the carbon of the oil less the carbon in the gas bears some practical relation to the free hydrogen of the gas, ten samples of gas from the old method were tested. These samples showed an average proportion of 22.5 to 1 in a comparison of weight of uncombined carbon vapor and hydrogen. In no sample did the proportion fall below 21.3 or exceed 23.3 to 1—22.5 then might be considered a fair average relation, but only on this type of machine and under the same running conditions. Undoubtedly the entire marsh gas content of the oil gas made by the old method is solely the result of the distillation of the oil. The hydrogen content therefore of the gas represents the maximum liberation of free hydrogen.

As the general running conditions of the new and old method are similar, it is permissible to apply this proportion to the new process. Let us consider the ten-minute run of the velocity test. After we make proper deductions from the total oil for .5 gallon of tar per thousand feet, we find 46.51 lbs. of carbon introduced. The gas contained 18.417 lbs. of carbon, leaving as uncombined 28.09 lbs. of carbon. Applying our proportion theory to this quantity of uncombined carbon, we find the hydrogen content of the gas derived from the oil to be 39.4%. From the oxygen content of the gas, we find the hydrogen content from steam to be 13.3%, or a total hydrogen content of 52.7%. The gas by analysis showed only 43.7% hydrogen; therefore 9% of the freed hydrogen has been recombined and appeared in the gas as marsh gas.

This same theory applied to the eleven-minute run shows 8.9% of hydrogen to have been converted into marsh gas and 11.2% in the thirteen-minute run. If we deduct the percentage of marsh gas formed synthetically and deduct equally for carbon monoxide from the analysis of the ten-minute run and add to the hydrogen and carbon dioxide in proportion to the equation of its formation, we have the following comparison:

	Gas Analysis of 10 Minute Run.	Same Analysis Stripped of Synthetic Marsh Gas.
CO_2	3.0	.8
CnH_2n	6.1	5.8
O_2	0.0	0.0
CO	7.3	11.0
H_2	43.7	50.0
CH_4	35.6	29.1
N_2	4.3	3.3

The second analysis is reduced slightly in all its constituents, as the volume of the marsh gas formed was not equal to the original volume of its components. The second analysis stripped of its synthetic marsh gas is a typical analysis of the gas produced in the old process. To more clearly show the positive effect of the catalytic atmosphere on the quality of the gas and especially on the production of the marsh gas, a curve has been plotted of the constituents of the gas each minute of the fourteen-minute run. The gas used for the catalytic atmosphere dropped twice during this run from 700 to 600 cubic feet per minute. These drops in the third and eighth minute affected materially the gas produced in the following minutes.

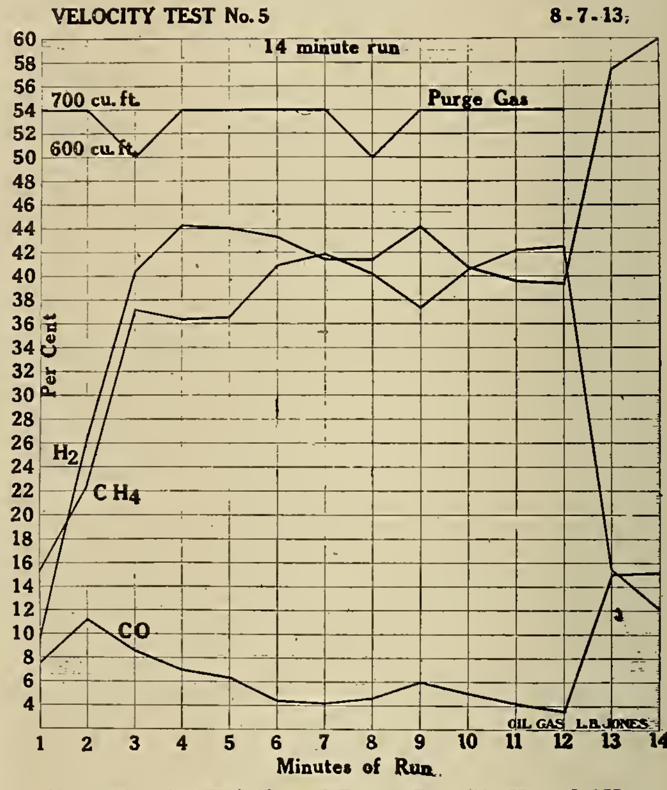


Chart Showing Relation of Purge Gas, CO, H_2 and CH_4.

The oil used per thousand cubic feet of gas made in the new process is not at the present time greatly less than in the old method, but the gas is far superior. The production of synthetic marsh gas in an oil gas set opens great possibilities for the future oil gas. With the eventual abolition of the candle-power standard, it marks the way to the production of a high heat

unit gas with very little candle-power at a reduced cost.

While the gas of the new process embraces 15 per cent more carbon than the gas of the old method, this amount only constitutes 5 per cent more of the total carbon used. The average carbon content in a thousand cubic feet of the old oil gas is 17 lbs. and in the gas of the new process 19½ lbs. While this is a considerable increase, there is vast room for improvement. In order to produce a gas of the quality of that made in the ten-minute run shown without any by-products of lampblack or tar and no loss of carbon at the stack, a thousand cubic feet of gas would have to be produced from 21.6 lbs. or 2.7 gallons of oil. This of course would represent 100 per cent efficiency. If the lampblack were eliminated and the loss at the stack stopped and we still produced one-half gallon of tar and the same quality of gas, a thousand cubic feet would then have to be produced from 25.7 lbs. or 3.2 gallons of oil. It appears from these figures that while great progress has been made in the efficiency of production of oil gas, we are still far from what might be considered good efficiency. As a matter of fact, in the best results yet attained, the carbon of the gas represents less than 40 per cent of the carbon of the oil. These figures are based on actual carbon used as oil and carbon in the gas and may seem low to one who is accustomed to compare the carbon in the gas with the lampblack by-product. In the new process as well as the old, the actual carbon accounted for as gas, lampblack and tar seldom exceeds 60 per cent of the carbon of the oil. The greatest loss of carbon is at the stack, of which no account is kept.

The troubles with carbon accumulating in the early oil gas generators is responsible for the practice which still prevails of blowing the machine before each heating period. After the run is taken off, all the available air at the greatest available pressure is turned into the machine for three minutes, at the end of which time the air is reduced and oil turned in for heating. During the run, there is a slight accumulation of carbon on every checker brick and during the blow the greater portion of this is wasted.

Often have we watched the sparks from our stacks at night, but few have reailzed that in those tiny sparks more fuel was being wasted than is introduced as oil in the following heating period.

In the operation of the old process in which 20 lbs. of lampblack of 55 per cent moisture or 11 lbs. of dry is recovered, and approximately 7½ gallons of oil are used, after allowing for one-third of a gallon of tar, shows a loss at the stack of 20 lbs. of carbon per thousand.

This amount in a run of 50,000 feet production amounts to 1000 lbs., or 2½ times the amount of heat oil used. This carbon in the aggregate is of considerable amount, but when divided over 30,000 checker bricks amounts to slightly over one-half ounce per brick, which represents a film of one-thousandth of an inch thick on the exposed checker brick surface.

Apparently there is no hope of preventing this loss, as it must be cleared from the machine after each run, or it would soon accumulate and form a stoppage. If this could be stopped, a gas of the same quality might be produced with the same quantity of by-product of lampblack and tar from 4.4 gallons of oil. This loss, therefore, represents the carbon content of 2.6 gallons of oil per thonsand. It seems impossible at the present time to stop the loss and thus save a large quantity of oil, but a large portion of the loss can be utilized and thus will not represent a total loss. The carbon accumulation not only amounts to over twice the amount of fuel required to heat the generator each run, but is distributed evenly throughout the checker work, and this presents an ideal fuel for the uniform heating of the checker brick. An equal amount of fuel is burned and an equal amount of heat liberated on the surface of each checker brick. In order to utilize this carbon for heating the set, after the run is taken off, a very small quantity of air is introduced into several points in the set. Besides the carbon on the brick, this method utilizes the greater portion of the gas remaining in the machine from the previous run. This amounts to over 3000 cubic feet on the large sets of a gas of over 350 B.t.u.'s, or over a million heat units, equal to nearly 7 gallons of oil. This not only utilizes a large quantity of heat which is no wlost, but eliminates the smoke nuisance of a gas works, which at the present time is attracting considerable attention.

With a few such refinements, the oil gas works of the future may be considered a desirable neighbor rather than a nuisance.

This new method of heating has only been introduced and practically demonstrated at the Metropolitan plant within the past few weeks. No radical changes were made in introducing this method, but it was endeavored rather to gradually reduce the quantity of heat oil until a point was reached where a loss in temperature or an increase in time required to heat would make further reduction false economy.

At the present time, the first five minutes of the heat are devoted to burning the gas and carbon in the machine with a very light blast and the remaining five minutes, oil is used. In this way, the heat oil has already been reduced 45 per cent, or over one-half gallon per thousand cubic feet of gas. While this and a possible greater reduction, until little or no heat is used, is of great importance, a feature of perhaps greater importance is the quality of the heat produced. Before this new method of heating was introduced and oil was used exclusively for heating, the drop in temperature of the checker brick just below the primary and secondary make chambers during a run was seldom less than 250° F. With the new method using the same quantity of oil during the run, the drop seldom exceeds 100° F. This shows that a far more substantial and uniform heat is produced.

In all of the experiments described, a distillate of about 18° B. was used and undoubtedly better results could have been obtained with crude oil.

The Metropolitan Works is not an experimental plant, but is one of the large producers for the supply of San Francisco.

While this plant produces over three million feet per day, at no time has the lampblack and tar by-product been more than sufficient for boiler fuel.

ELECTRICAL PUMPING AND IRRIGATION

THE SELECTION AND INSTALLATION OF A SMALL PUMPING PLANT.

BY B. A. ETCHEVERRY.

The proper selection of a pumping plant depends upon many factors which should be carefully considered by the intending purchasers. These factors are: (1) Source of water supply; (2) capacity of plant and period of operation; (3) the kind of pump; (4) the class of engine or driving power; (5) the first cost; (6) the fuel cost; (7) the cost of fixed charges and attendance. These factors are interdependent and should be considered together. Their relative importance will vary with local conditions and for that reason it is not possible to state definite rules which will apply in all cases. A study of the conditions affecting each factor is therefore necessary in each case.

Source of Water Supply.

The source of water supply may be surface water supply, such as water occurring in rivers, lakes, canals, etc., or may be ground water supply. Where surface water is available, the water will be developed by means of a proper intake, which for the simplest cases will consist of the suction pipe of the pump extending into the body of water. Where ground water is available the most common means of development is by wells.

Wells.

The well may be a dug, bored or drilled well. The most common form of well for individual pumping plants in California is a drilled or bored well 10 to 16 inches in diameter or larger, lined with a casing, which may be one of the three following types:

1st. Standard steel screw casing.

2nd. Single galvanized iron casing, No. 12 to 16 gauge, with joints riveted together.

3rd. Double black steel casing, No. 12 to 16 gauge, known as California stove-pipe casing, and very generally used in Southern California. This casing is made of riveted steel sections 2 ft. long placed with broken joints. The bottom of the casing consists of a starting section 15 to 20 ft. long, made of triple thickness, riveted together, and with a steel shoe at the lower end.

The well and casing should extend into the water-bearing gravel sufficiently far to give a perforated area equal to at least five times the cross section area of the well. The perforations are made with an improved cutting tool, and consist of 6 to 8 slits made in each ring or circle; each slit 12 to 18 in. long and 3/8 to 3/4 in. wide. A space of 4 in. is skipped and another ring of slits staggered with the adjacent ones is made. Slits should not be over 18 in. long with stove-pipe casing.

In Southern California, near Chino, the price of drilling deep wells is as follows:

For 10, 12 and 14 inch wells in fine material, $1.25 per ft. for first 500 ft.

For 16 inch wells in fine material, $1.50 per ft. for first 500 ft.

For depths greater than 500 ft. the price is 50 cents extra on each additional foot.

The cost per foot of steel stove-pipe casing is about as follows:

Diameter.	12 Gauge.	14 Gauge
10"	$1.12	$0.92
12	1.27	.99
14	1.51	1.12
16	1.80	1.24

Capacity of Plant and Period of Operation.

The required capacity of the plant will depend on the area irrigated, the duty of water or depth of water required on the land and the period of operation. For ordinary orchard soil a total depth of 12 in. of water during the irrigation season will be sufficient for young orchards. For a full-bearing deciduous orchard 18 in., and for a citrus orchard, 24 in. should be ample, while for alfalfa and other forage crops 24 to 36 in. is plenty. Where the cost of pumping is high, such as for small plants and high lifts, it will usually not be feasible to grow at a profit anything but orchards. To reduce the cost of pumping, no excess water should be used, all losses should be prevented by careful irrigation and thorough cultivation, in which case a young orchard on fairly deep retentive soil may not require more than 6 to 9 in. of irrigation water and a full bearing orchard not more than 12 or 15 in. for deciduous trees and 18 in. for citrus trees during the irrigation season. To put a depth of 2 ft. of water on one acre, it takes a flow of very nearly 1 cu. ft. per second for 24 hours; this is equivalent to 450 U. S. gallons per minute for 24 hours. This relation can be applied to any case to obtain the size of the pump. For example, if it is desired to irrigate a 40-acre orchard 1½ ft. deep, in an irrigation season of 120 days, this requires 60 acre feet in 120 days or ½ of an acre foot per day. This will be obtained by a pump giving ¼ of a cu. ft. per second, or 110 U. S. gallons per minute, when the pump is operated continuously 24 hours a day every day during the irrigation season of four months. For a 10-acre orchard the required capacity based on the same conditions would be ¼ of the above, or 28 gallons per minute, or 1/16 of a cu. ft. per second.

The above two examples are based on a pump operating continuously at the rates given above. While continuous operation decreases the required size of plant, it is usually preferable to select a plant of larger capacity and operate it only a part of the time. This is especially desirable for very small orchards, in which case continuous operation gives a stream too small to irrigate with. The other disadvantages of continuous operation are:

1st. Continuous operation requires continuous irrigation and constant attention to operate the pumping plant. For very small tracts a regulating reservoir may be used, but it must be of considerable capacity to be of any service, and it must be lined with concrete to prevent seepage losses of the water, which when pumped is too valuable to lose. Usually it is

preferable to purchase a larger plant and do without a reservoir.

2d. Continuous operation gives a small stream which cannot be applied economically.

3d. Continuous operation means that the water cannot be applied to the different parts of the orchard within a short time, so that only a small part of the orchard or farm receives the water when most needed, and the remainder must be irrigated either too early or too late.

4th. A small plant is less efficient and requires a proportionately larger fuel consumption than a larger plant to pump the same quantity of water.

On the other hand a very short period of operation requires a comparatively large pumping plant, which will greatly increase the first cost of installation, the interest on the capital invested, the depreciation and fund necessary to provide for renewal. It also requires a larger source of supply, which may not always be available. For instance the required flow may exceed the capacity of the well or may so lower the water plane that the cost of pumping will be increased. Also in some localities the power company may offer a low flat rate for continuous use.

Usually it is desirable to operate the pump not over 1/2 or 1/3 of the time during the irrigation season and often a shorter period is desirable. This requires a pumping plant two or three times or more the size required for continuous irrigation. The capacity of the pump must be sufficient in all cases to give a large enough stream to irrigate economically; even for the smallest orchards a stream of at least 5 to 10 miners' inches or about 50 to 100 U. S. gallons per minute, is desirable.

For a full bearing orchard 18 in. of irrigation water for deciduous trees and 24 in. for citrus trees, applied in three to four irrigations of 6 in. each, at intervals of 30 to 40 days, should be ample in most cases. As stated above, where the water has to be pumped to high elevation, the higher cost of the water demands great care in its use and 12 to 18 inches total depth of irrigation water would be sufficient.

The table below gives the required pump capacity for various sizes of orchards or farms and for different

Necessary capacity of pumps in U. S. gallons per minute to give a 6 inch depth of water on the land each month when operated the following number of of 24 hour days each month.

Area. acres.	30 days.	20 days.	15 days.	10 days.	5 days.	2.5 days.	1 day.
5	19	28	38	56	113	225	563
10	37.5	56.25	75	112.5	225	450	1125
15	57	85	113	170	340	675	1690
20	75	113	150	225	450	900	2250
30	113	169	225	338	675	1350	3375
40	150	225	300	450	900	1800	4500
60	226	338	450	675	1350	2700	6750
80	300	450	600	900	1800	3600	9000
120	450	675	900	1350	2700	5400	13500

periods of operation. It is based on a depth of irrigation water of 6 in. each month, or 18 in. in 3 months, which is taken as the irrigation season. The period of operation is given in number of 24 hour days that the pumping plant is operated each month. These days need not be consecutive; for instance if the operation period is 10 days, instead of applying 6 in. of water in one irrigation lasting 10 days, the soil may be so porous and gravelly that it will not retain moisture, in which case it may be preferable to apply 3 in. at a time in two irrigations during the month, of 5 days each. The required pump capacity is given in U. S. gallons per minute.

The capacity of pumps for smaller or greater depths of water applied per month can be easily computed by proportion from the values given. For different areas and different periods of operation the capacity may be obtained by interpolation.

Kind of Pump.

The kinds of pump commonly used to raise water for irrigation are (1) centrifugal pumps, (2) power plunger pumps, (3) deep well pumps, (4) air lift pumps (5) hydraulic rams. Where the source of water supply is a surface body of water, either a centrifugal pump, a power plunger pump or a hydraulic ram will be used; where the source of water supply is ground water developed by wells, usually either a centrifugal pump, a deep well pump, or an air lift pump will be used and in some cases a power plunger pump. For deep wells usually the vertical centrifugal pump placed in a pit or an air lift pump is used. Hydraulic rams are used for small quantities of water such as for domestic purposes or for irrigation of small pieces of land. They are economical in operation, but reuire special conditions such as a nearby stream or canal with sufficient fall in a short distance.

A centrifugal pump consists of a circular casing with the inlet or suction end connected to the center and the outlet or discharge end formed tangent to the perimeter. Inside the casing is the runner or impeller keyed on the shaft and revolving it. It is formed of curved vanes closely fitting the casing. There are two general types: 1st, the horizontal centrifugal pump, which has a horizontal shaft; 2d, the vertical centrifugal pump with a vertical shaft. When in operation the impeller by revolving imparts a velocity to the water between the vanes and forces it away from the center of the casing towards the perimeter or rim of the casing through the outlet and up the discharge pipe. This produces a partial vacuum at the center of the impeller, which induces a flow through the suction pipe into the casing. The number of revolutions of the runner or speed of the pump has an exact relation to the head or lift against which the pump is working and for every head there is a speed for which the pump works most efficiently. This speed can be obtained from the pump manufacturers. It is important that the pump be connected to an engine or motor which will give it the proper speed. Overspeeding is preferable to under-speeding, but either reduces the pump efficiency.

Simple centrifugal pumps specially designed and driven at a sufficiently high rate of speed may be used for lifts considerably over 100 ft., but usually the stock pump obtainable from the manufacturers is not suitable for lifts over 75 ft., and for the smaller sizes the total life should not exceed 50 ft. For higher lifts compound or multi-stage centrifugal pumps are used. These consist of two or more pumps connected in series, the discharge of the first pump or stage is delivered into the suction of the next pump and the operation is repeated, according to the number of stages. Usually 75 ft. to 125 ft. is allowed to each stage. When the required capacity of the pump is over 100 or 150 gallons per minute and the total lift less than

75 ft. the centrifugal pump is no doubt the best adapted.

Centrifugal pumps are usually denoted by a number which represents the diameter of the discharge in inches. The efficient capacity of each size will vary to some extent with the speed of the pump, which depends on the total lift pumped against. The pumps can, therefore, not be rated accurately. The capacities given in the accompanying table are worked out from the ratings given by a reliable pump manufacturer, and are subject to considerable variations either above or below the values given.

Number of pump or diameter of discharge in inches	Capacity in U. S. gallons per minute	Capacity in second feet, or acre inch per hour	Number of acres irrigated 6 inches deep each month for operation period during the month of 30 days.	20 days.	15 days.	10 days.	5 days.	2½ days.	1 day.
2	100	.22	27	18	13	9	4½	2¼	9/10
2½	150	.33	40	27	20	13	6½	3¼	1 3/10
3	225	.50	60	40	30	20	10	5	2
3½	300	.66	80	53	40	27	13	6½	2 2/3
4	400	.90	110	71	55	26	18	9	3 2/3
5	700	1.60	190	127	95	63	32	16	6 1/3
6	900	2.00	240	160	120	80	40	20	8
7	1200	2.70	320	213	160	107	54	27	10 2/3
8	1600	3.50	430	287	215	143	72	37	14 1/3

To start a centrifugal pump the suction pipe and the pump must be filled with water or primed. This may be done by closing the discharge pipe with a check valve and connecting the suction end of a hand pump to the top of the casing. Where a steam engine is used, a steam ejector may take the place of the hand pump. For small pumps and low lifts a foot valve on the end of the suction pipe may be used and the pump primed by pouring water in the casing or suction pipe. The disadvantage of a foot valve is that if the water is not clear a small stone or twig may lodge itself in the foot valve and prevent priming. This will necessitate that the suction pipe be uncoupled and the obstruction removed.

The pump must be placed as near as possible to the water level to keep the suction lift down. While theoretically the suction lift may be as great as 33 ft. at sea level and about 30 ft. at an elevation of 3000 ft., it is desirable not to exceed 20 ft. and less is preferable. The horizontal centrifugal pumps is preferable where the depth from the ground surface to the water plans is not large. But where the depth is large, it is necessary to place the pump in a ddep pit, in which case either the vertical centrifugal pump or a deep well pump is generally used. A horizontal shaft centrifugal pump is usually more efficient than a vertical centrifugal, and it eliminates the end thrust of the shaft obtained with the vertical shaft which is difficult to balance properly. During the past few years a new type of vertical centrifugal, commonly named turbine centrifugal pump, has been developed for pumping from deep wells without the necessity of a pit. These pumps are installed inside the casing of bored wells 12 to 30 in. in diameter.

The plant efficiency can be increased by reducing the friction in the suction and discharge. As few bends as possible should be used and those should be made by using long turn elbows. The suction and discharge pipes should be larger than the intake and outlet openings of the pumps and joined to the pump with an increaser. The diameter of the suction pipe and especially of the discharge pipe should be 1½ times the diameter of the intake, and if the discharge pipe is long it may be economy to make the diameter even larger. Where the source of water supply is a surface body of water, enlarging the lower end of the suction pipe will further decrease the friction. This may be done by a funnel-shaped section whose length is about three times the diameter of the suction pipe and whose large end is about 1½ times the diameter of the pipe. The larger opening at the entrance to the suction pipe will decrease the tendency to suck up sand or gravel. When the water carries weeds, gravel, or other material a strainer should be used and the total area of the strainer should be at least twice the area of the suction pipe. The discharge pipe should not carry the water any higher than necessary.

Power piston or plunger pumps are used where the water is obtained from a surface source or where the water plane is near the surface of the ground and the lift to the point of delivery is large. It consists of one or more cylinders, in each one of which a piston or plunger moving backwards and forwards sucks the water into the cylinder and forces it up the discharge pipe. When the cylinder has only one suction valve and one discharge valve, the motion of the piston in one direction causes suction and the displacement in the opposite direction forces the water through the discharge pipe. With two sets of valves so arranged that there is a discharge for each displacement of the piston, the pump is known as a double acting pump. When the pump has two cylinders, it is known as a duplex pump, with three cylinders it is a triplex pump, and in either case may be either double acting or single acting. The cylinders with the driving gears or pulley are assembled together and built at a height above the water plane, which must not exceed the suction lift.

[To be continued.]

EXAMINATION FOR ASSISTANT IN LABORATORY PHYSICS.

The United States Civil Service Commission announces an open competitive examination for laboratory assistant in physics, for men only, on October 8, 1913, to fill vacancies as they may occur in the Bureau of Standards, at salaries ranging from $900 to $1200 per annum. Persons who desire this examination should at once apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any local office.

The new quarters of the Weber Club in the Kiesel Building, Ogden, Utah, now in course of erection, will be equipped with every modern electric convenience, including an electric churn which will produce fresh butter daily for the exclusive use of club patrons and an electric press for the manufacture of fresh cider from luscious Utah apples. All cooling will be done by a modern refrigerating plant, contract for which has been placed.

INDUSTRIAL APPLICATION OF ELECTRIC HEATING.[1]

BY W. H. LINES.

The use of electric energy for producing heat in industrial processes presents the same relative advantages over the combustion of fuel as does the electric tric drive over the older methods of transmitting energy. Cleanliness, safety, flexibility, efficiency, increased production, improvement of working conditions, and a better product, are as apparent here as in other older applications of electric energy. The growth in the use of electric energy in this field has been enormous in the past five years, far outstripping the increase in the use of electric energy for lighting and power purposes. The field of application is almost unlimited, and we find that new industries have been created by the aid of electric heat in processes only possible by this method.

General View of Electric Smelting Plant at Heroult, Cal. Incline Tramway in Left Background, Smelter Building in Center Foreground, Lime Kilns at the Right.

To accomplish a change from electric to heat energy, three different processes are open to commercial usages:

(1) The Joulean effect.

(2) The electric arc.

(3) The electrolytic effect.

The Joulean effect depends for its operation on the resistance of an electric circuit. The temperatures to be obtained are only limited by the limiting temperature of the resistance material. Temperatures as high as 5500 degrees, Fahrenheit, have been successfully obtained.

The electric arc produces the highest artificial temperature known, 6500 degrees, Fahrenheit, being the limit at which the carbon electrodes melt. Even higher temperatures may be reached as our knowledge of heat-resisting elements becomes wider.

In the electrolytic effect, electric energy is changed partly into chemical energy required for the process in the cells and partly into heat energy. The resultant heat energy gives the desired temperature.

The Joulean effect is the most commonly used of these three methods of energy transfer, and it finds application in hundreds of uses in domestic and industrial fields. The heating and cooking devices used for domestic purposes employ this effect, but they are so well known and their value as revenue producers to the central station so well appreciated that no mention will be made of them in this paper.

There is scarcely a single process in the industrial world requiring heat for its proper execution which cannot be done better, and in most cases cheaper, by the use of electricity than by the combustion of coal, gases or oil. For the purpose of this discussion I will divide the industrial application of electric heating into three general classes:

(1) Those arts and industries requiring heat energy in relatively small amounts for the completion of the process.

(2) Industries requiring heat energy in large amounts and usually at high temperatures.

(3) The use of electric energy for building heating.

In the first class there is an almost unlimited field for the successful application of electric heating. There are but comparatively few industries which do not require heat energy for at least one step in the process. In order to give some idea of the scope of this work and the great opportunity looming before the energetic new business manager, I will cite a few of these processes to which electric energy can and has been successfully applied.

In the metal trades: For melting small amounts of metal, for welding metals both by arc and spot processes, for tempering steel by the fused bath and oil tempering processes, for soldering, for enameling and japanning in ovens. In the printing and publishing trades: For heating stamping and embossing heads, matrix dryers, glue cookers, pots, etc. In the shoe and leather trades: For finishing and ornamenting leather, for treeing and ironing and for supplying small amounts of steam from an electric boiler to stitching machines. In woodworking: For glue pots and tools for producing designs. In the textile trades: For finishing rolls for silk mills, for embossing rolls for designs, for drying twine and thread and for forming hats. In laundries: For ironing and for heating sleeve, neckband, collar edging and shaping machines. In the paper industry: For heating finishing rolls for high-grade paper, for waterproofing paper and for heating automatic paper box machinery. In confectioneries and bakeries: For chocolate warmers, bake ovens, etc. In garages: For heating vulcanizing moulds. In hospitals: For sterilizing instru-

[1]A paper read at the Sixth Annual Convention of the Northwest Electric Light and Power Association.

ments and for heating various appliances for surgeons, etc.

Electrical devices, in order to accomplish the results desired, have been developed and used successfully in all the lines above enumerated, to the complete satisfaction of the user and to the material profit of the central station.

In the use of electric energy to furnish heat in large quantities for the proper completion of various industrial processes, the writer firmly believes, lies the solution of one of the most vital problems now before the central station companies of the northwest, to find a market for the sale of large blocks of surplus energy resulting from the over-development of our water powers or for the disposal of inherent electric energy now going to waste over undeveloped water power sites.

Most of the central stations of the northwest are in a peculiar position at the present time. We find ourselves in possession of surplus water power, either developed or under development, and no commercial market for its ready disposal. Usually this over-development was made in anticipation of a growth in population and industry, which has not materialized or was brought about by a forced development to hold water power sites in order that they would not revert to the state or nation. Again, the fact that this energy cannot be sold in the ordinary commercial markets is no reflection on the ability or aggressiveness of our various new business departments. An analysis of our connected load and gross earnings per capita shows that we are far ahead of the eastern companies and are securing more than our share of the available business. The field has been worked intensively, and the opportunity to sell more power is lacking. We must look to some other than the local markets to dispose of this surplus energy.

In addition to the surplus energy resulting from the over-development, we have immense amounts of power going to waste over undeveloped water power sites. We of the western states are in a far different postion than our eastern brethren. We have opportunity for the development and sale of large blocks of power at a figure undreamed of in communities where steam generation reigns supreme. In the States of Washington, Oregon and California alone there is economically capable of development over 23,000,000 h.p., or over 45 per cent of all the available water power in the country. This water power represents a natural resource, the inherent value of which is stupendous, but before any real value can accrue to it a market for its sale must be found. The entire demand for power for industrial purposes in the United States today does not exceed 30,000,000 h.p.; so it can be readily seen that it will be a matter of generations before all of this potential power will become ready for economic development.

On account of lack of density in population we cannot hope to build up large industries which will serve our own territory exclusively for some time. We cannot hope to build up industries which can sell their product in the East in competition with the eastern manufacturer on account of prohibitive transportation charges, except in those few cases where the accessibility of raw material dictates loaction on the coast. We must confine our efforts in securing those classes of business in which the element of the cost of power is the vital consideration and where the finished product is not so bulky as to make transportation charges excessive.

There is a certain class of industries coming within the scope of the above requirements, and I firmly believe that here on the Pacific Coast we have excellent opportunity to promote such industries and thus create a market for our water power. I refer to those industries requiring the use of electric furnaces of proper design for their successful operation. Among the more prominent of these might be mentioned:

(1) The reduction of iron ore and the manufacture of pig iron.

(2) The refining of steel.

(3) The manufacture of aluminum, carborundum, artificial graphite, emery, calcium carbide, iron and aluminum alloys, phosphorus and various nitrates.

It is beyond the scope of this discussion to go into a detailed description of the above processes, but I would like to call attention to the fact that the use of electric energy is of vital importance to their successful application and that the load demanded by the various processes is an ideal one for central stations to handle. The load is continuous and the load factor all that can be desired. Arrangements can easily be made to operate off the system peak, thus demanding little or no additional generating capacity over that already provided to take care of the system demand. Low rates must be offered before any of these propositions can be made attractive, but here is a justification, if anywhere, for an extremely low rate.

The Manufacture of Pig Iron.

During the past few years there has been developed and put into commrecial operation in Europe several types of electric furnaces for the reduction of iron ores. After years of experiment and partial failure, several processes were perfected and the commercial results fully justify the faith of the early promoters in this line. In America, several furnaces patterned after those in Europe have been built and proven eminently successful. The electric smelting of ore, however, is limited strictly to certain conditions in order to make it compete successfully in the market with pig, made in the ordinary blast furnace. Under a condition where rich beds of ore are located adjacent to or near water power sites and limestone, where the cost of coke is relatively high and freight rates on competing pig iron also high, this method of reduction can compete successfully. It is surprising in how many cases we find just such circumstances. Here on the Pacific Coast, conditions such as these obtain frequently. California has at least two electric furnaces for the reduction of ore in successful operation and I see no reason why there is not an opportunity for some such development in the Northwest. It is true that our ore deposits are rather limited and usually of a poor grade, but we can bring ore in by water at a low figure. Carbon of some form is necessary for the proper chemical reaction in making iron, and charcoal can be used for the purpose and give a much more

satisfactory product than the coke generally employed in blast furnace operation. It should be noted that in the electric furnace, only about one-third of the coke used in the ordinary blast furnace is required.

The two most common types of electric furnaces are the Heroult and the Girod, both being of the electrode type. There is another furnace known as the induction type, but experience so far dictates the use of the electrode type. In both the two types (the Heroult and the Girod) the heat is developed from a combination of the arc and the resistance of the charge, the difference between the two types being in the fact that in the Heroult furnace, the arc is formed between the electrodes at the top of the furnace and the charge for the other electrode, while in the Girod type, the bottom electrodes are formed of iron, water-cooled.

Three-Phase Electric Furnace Specially Designed by the Noble Steel Co. at Heroult, Cal. This Differs Inherently from the Heroult and Girod Types

Electric Steel.

By far a wider field of application of the electric furnace can be found in the making of steel from iron, particularly the higher grades of product, such as tool, projectile and automobile steel. Electro steel has many advantages over that made by the Bessemer, open hearth and crucible processes. There is an entire absence of gases, such as hydrogen and oxygen, in the finished product; no flaws or blowholes. It has a higher elastic limit, forges better, withstands higher temperatures and the process enables the manufacture of special alloys, not possible by other methods.

The electric furnace is essentially a "closed" open hearth furnace, as the process is carried on in a closed retort, thus eliminating any oxygen or free air, while in the Bessemer process the blast which accompanies the heat brings in oxygen, as does the flame in the open hearth process. Undoubtedly the absence of oxygen in the electric furnace is responsible for the smaller percentage of sulphur, phosphorus, oxide and suspended slag, thus giving a much higher grade of product. Electric steel is in great demand in the country today and commands a higher price than crucible steel, and this in face of the fact that it can be produced cheaper than in the crucible process. The cost of power is the determining factor in the refining of steel electrically, and here on the Coast we have an unusual opportunity for its successful application.

Carborundum.

Carborundum is a material obtained from the fusion of carbon and silicon in an electric furnace at a temperature of approximately 6000° F. The furnace is lined with firebrick and several carbon terminal rods, to which cables for carrying electric energy are fastened, are brought in at the top. Sand and coke or charcoal are placed in the furnace around a core of ground coke. The core completes the circuit between the terminals and offers a path of high resistance, thus producing a very high temperature. The resulting carborundum is crystalline in structure and from this is made many commercial products. It is an ideal abrasive and is used extensively in grinding tools. It is extremely refractory, withstands high temperature and hence is useful in lining furnaces where high temperatures are developed. It is a powerful deoxidizing agent and is used very extensively in the refining of steel. It has a high thermal conductivity and finds extensive application in moulds for alloys, extracting heat very rapidly.

Calcium Carbide.

Calcium carbide is formed in an electric furnace by the fusion of limestone and some form of carbon, such as coke or charcoal, at a temperature of from 5400° to 5700° F. It is an extremely valuable product and is used extensively in lighting systems and in the manufacture of nitrates for fertilizers.

Fixation of Atmospheric Nitrogen.

There are two processes for the production of various nitrates from the air:

(1) The direct separation of oxygen and hydrogen in the air is effected by the air being brought to a high temperature over a large and extenuated electric arc. The free hydrogen is then combined with other elements to form a stable compound for commercial use such as the various nitrates used for fertilizers.

(2) The nitrogen in air is combined with calcium carbide in an electric furnace to form cyanamide.

Nearly all of the above processes are capable of successful development and operation in the Northwest provided electric energy is available at a figure low enough to make them commerially feasible. In Europe the average rates paid for electric power in

large blocks for these purposes vary from $7.00 to $15.00 per kw.-year. Electric energy can be sold here at rates even higher than these and products obtained which will compete successfully on the Pacific Coast with equivalent products in the East and in Europe. If we are alive to our opportunities we will do all we can to encourage and foster the development of industries such as these on the Pacific Coast, and thus find a market for our vast water powers. If we do not seize this opportunity other agencies will. During the last session of the Oregon Legislature a bill was put through appropriating $15,000 for surveys and preliminary plans for a state development of water power aggregating 100,000 h.p. with the idea of disposing of this power to private concerns, manufacturing the various products which I have very briefly described.

Electric Building Heating.

I cannot see how the heating of buildings electrically will ever work out as a commercial proposition in competition with the direct combustion of fuels, except in those few isolated cases where fuel is high, cheap water power available, close temperature regulation required and the area to be heated relatively small.

This is often impracticable and not at all an attractive business for a central station to handle. It has been argued that if a company has surplus power available, it can well afford to sell it at a flat rate per month or per year for building heating, even if the resultant rate per kw.-yr. is very low, but to my mind, this would establish a very dangerous precedent. If we could afford to sell energy for building heating at such low rates, why should we not offer the same rates to other industries using the energy under substantially the same conditions of demand and load factor? The heating business offers the further objectionable feature of being a winter or peak load business and hence less desirable than the ordinary commercial power load.

ELECTRICAL GOLFERS AT GEARHEART.

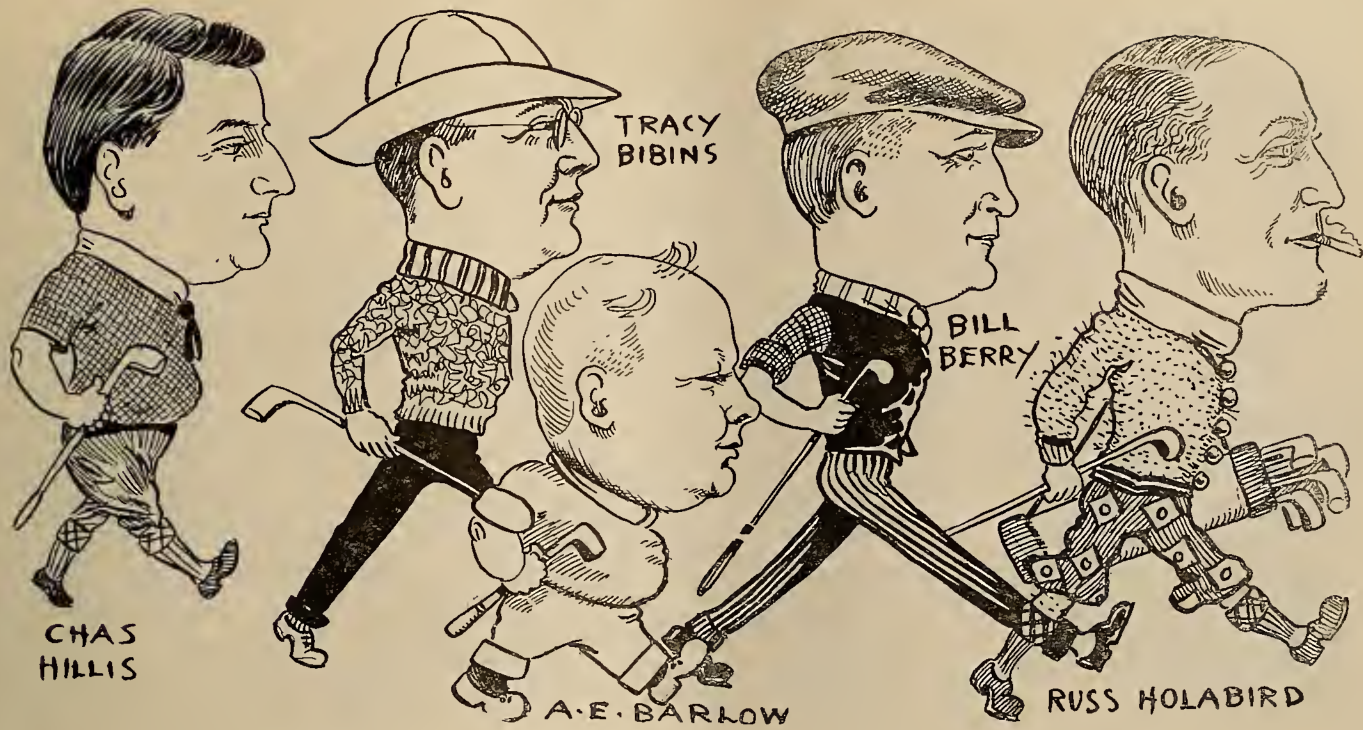
The irregular quarterly convention of the Pacific Coast Electrical Supply Golfers Association was held at Gearhart, September 18-20, 1913. For the benefits of those not natives of the "webfoot state" it may be necessary to say that at the extreme western edge of Oregon, the wettest dry state in the union, is a beautiful hotel facing the six thousand miles of the tossing waves of the Pacific to the west.

The clans foregathered from north, east and south on Thursday morning when they took their special car from Portland. About a score of Californians had journeyed together from San Francisco without appearing any the worse of wear, though Sanderson did strenuous duty as nurse for Burger. As many more from other points of the compass, including a golf-delayed party from the Buffalo convention, added to the confusion of the baggage man. Indeed Ed. Rockafellow managed to maintain his reputation as a good loser, not only of sleep and baggage, but also of golf. Fred Skeel has yet to make reckoning with a certain estimable lady who did not see Lake Louise because of his procrastination.

Electrical Jobbers and Manufacturers Leaving Portland for Gearheart.

A convention is a fine place to meet men in an unconventional manner. Witness the clam digging and sea-dipping episodes which occupied the attention of those fortunate enough to escape Thursday afternoon's meeting! Our artist has caught some of the episodes of the trip in a manner more flattering than realistic, but an elastic imagination can supply the deficiencies.

It goes without saying that golf was the all-absorbing avocation. The perpetual handicap committee, however, gave Brainard a big job when they fixed it up for him to fill the four cups which he won, the Patton, Everready, Jobbers and Hotel Gearhart. The Portland Jobbers sprung a surprise in the form of the smallest cup on record awarded the largest gross score, handily won in a long walk by F. H. Murray, with a score of 197. All precedent was reversed by



publishing the conditions and sealing the cup, to which some of the envious ones ascribe Mr. Murray's sudden interest in the Scotch game.

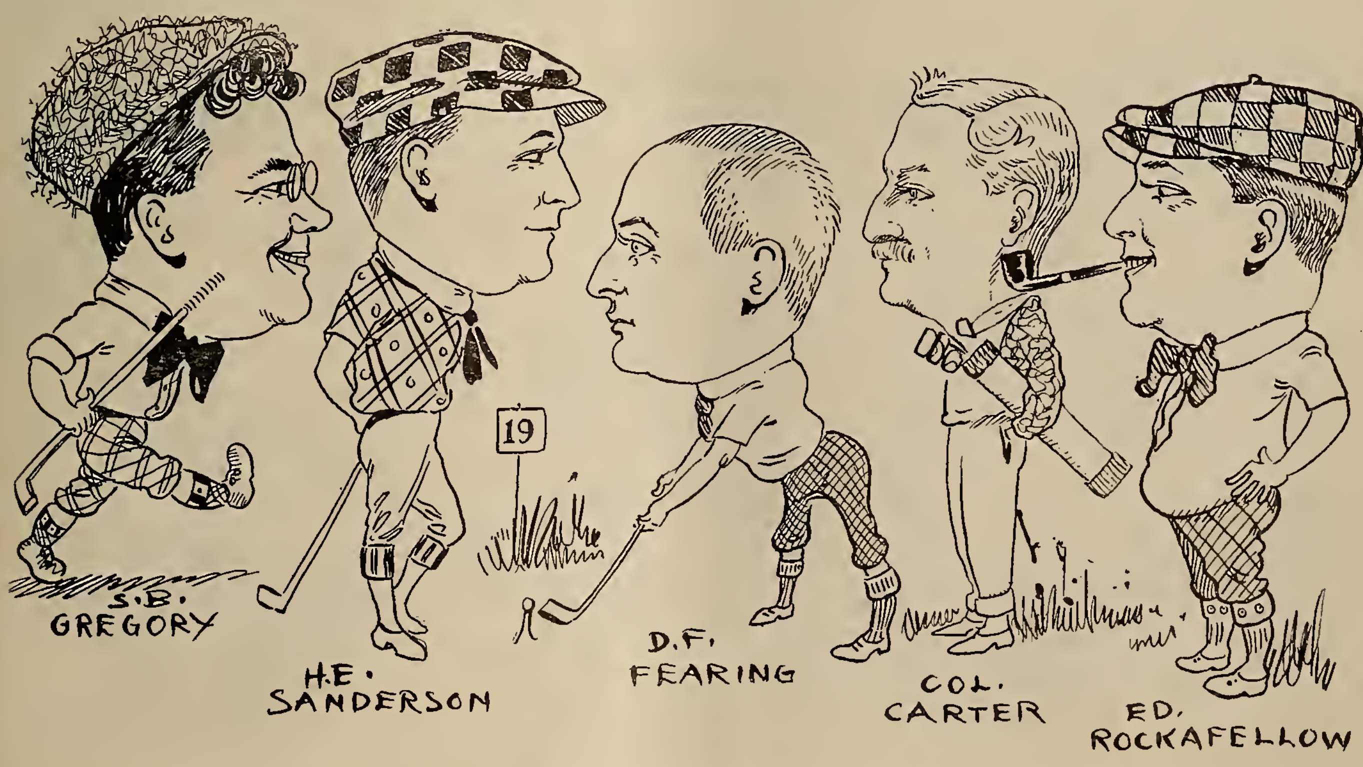
The honor or having won the Contractors' cup is still undecided, as the worthy secretary made his escape with the conditions of the sealed handicap in his pocket just nine hours before the scores were announced, a certain blonde lady with whom he took an automobile ride being perhaps responsible. As Russ Holabird and Bill Goodwin were tie in having the gross score nearest to the average gross this matter has been left to the god of chance. Here's luck!

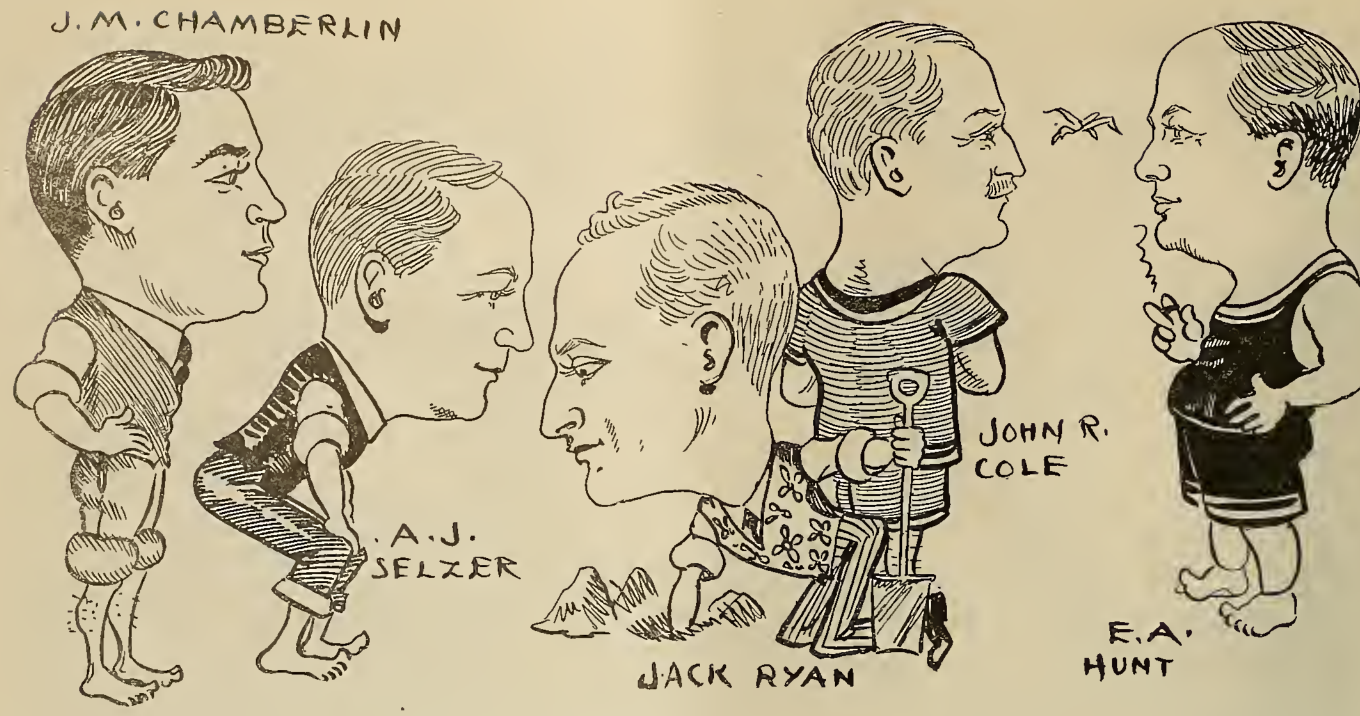
Garnett Young won the Manufacturers' cup, the lynx-eyed, close-mouthed, short-eared, long-nosed committee having taken the precaution to handicap Sanderson so severely that even Col. Bogie would have had to go some.

Jobbers' Tournament, September 20, 1913.

Net Scores.

	Gross Score.	Patton Cup.	Jobbers and Hotel Gearhart.	Ever Ready
W. S. Berry	101	106	114	160
T. E. Burger	101	101	100	101
H. D. Brainard	93	100	98	98
H. V. Carter	109	114	115	114
C. C. Hillis	100	107	108	107
R. D. Holabird	102	109	117	109
W. L. Goodwin	102	107	115	107
E. W. Rockafellow	97	102	103	102
F. N. Killam	121	103	103	102
C. B. Hall	123	113	115	113





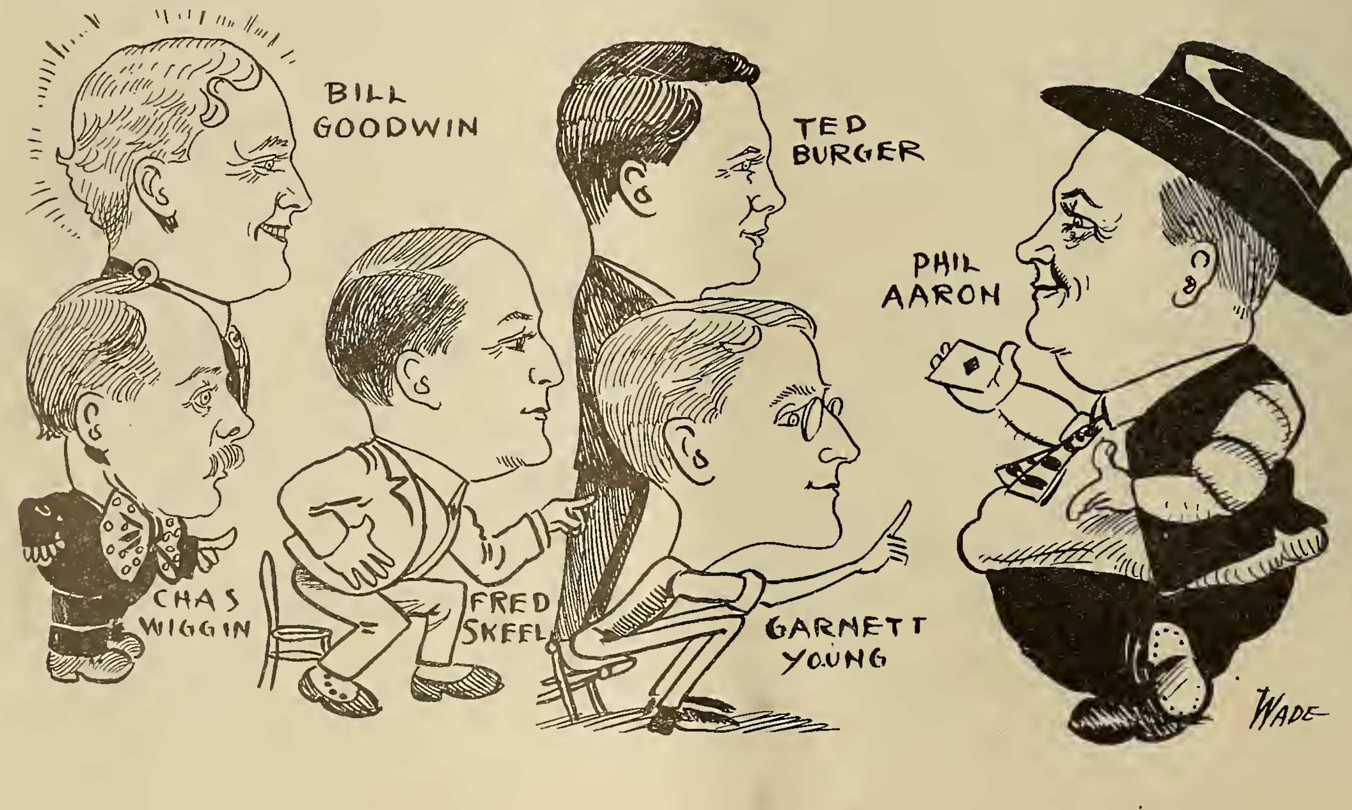
The title of champion clam-digger belongs without question of doubt to Jack Ryan. John Cole won the pool tournament while Ted Burger excelled as a seal. Nothing need be said of the magnificent showing in the water polo and the sea-water tug-of-war. Space also compels us to leave to the imagination of our readers, the glorious fires of drift-wood on the beach, the clandestine razor clam-bake and other escapades about which some of the participants are still dreaming.

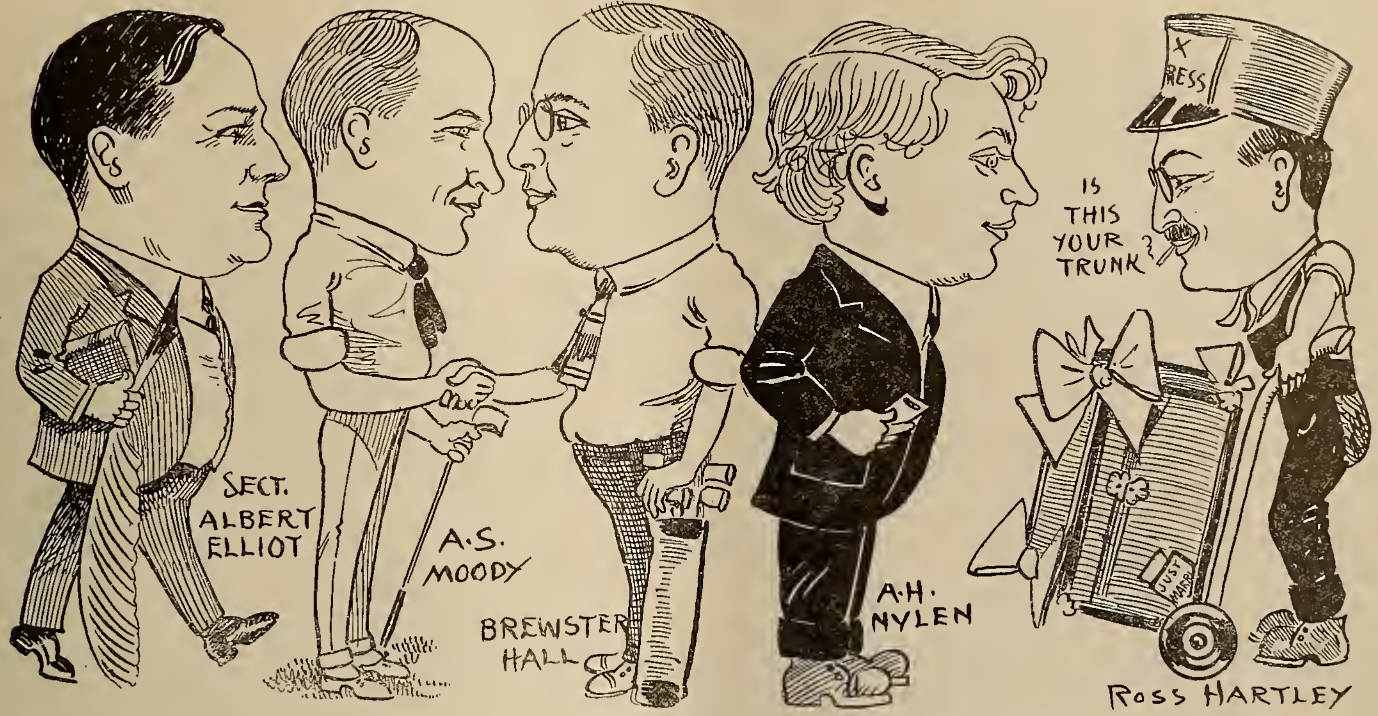
The convention came to a fitting close with the usual golf dinner on Saturday night with Col. H. V. Carter at the post of honor. On Sunday morning the party returned to Portland, where they enjoyed the hospitality of the local electrical men before returning to their usual strenuous work.

Manufacturers' Handicap for Tournament, September 19, 1913.

Based on 100.

	Gross.	Hdp.	Net.
Barlow	113	—18	95
Bibbins	98	+ 4	102
Cole	114	—18	96
Gregory	108	— 1	107
Hall, W. B.	113	—18	95
Hunt	120	—18	102
Murray	168	—24	144
Moody	108	0	108
Sanderson	88	+15	103
Skeel	100	—10	90
Steel	118	—18	100
Fearing	128	—18	110
Young	92	— 4	88





The following were guilty:

Mr. and Mrs. A. E. Barlow—American Ever Ready Company, San Francisco.

Mr. and Mrs. W. S. Berry—Western Electric Company, San Francisco.

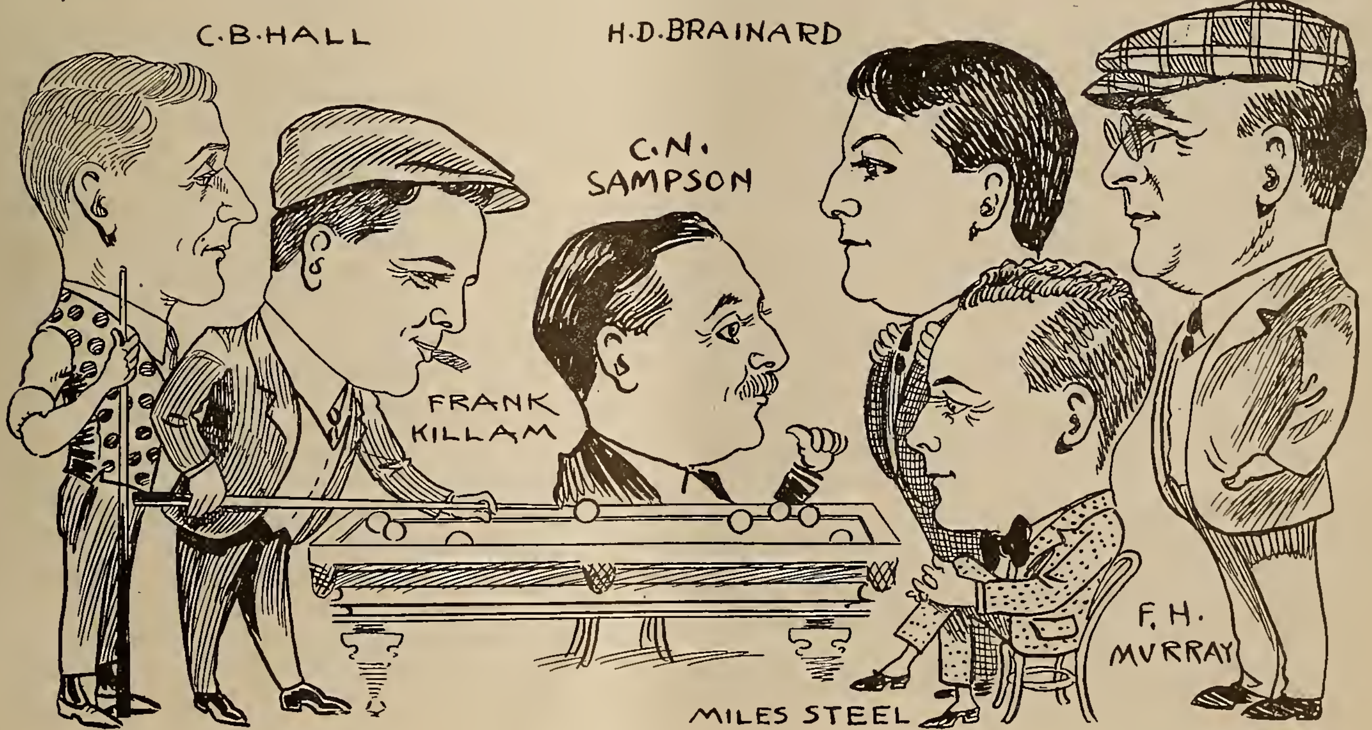
Mr. and Mrs. W. L. Goodwin—Pacific States Electric Company, San Francisco.

Mr. and Mrs. Ross Hartley—Pacific States Electric Company, Portland.

Mr. and Mrs. A. H. Nylen—Gilson Electric Company, Oakland.

Mr. and Mrs. E. W. Rockafellow—Western Electric Company, New York

P. J. Aaron—Fobes Supply Company, Seattle, Wash.
T. E. Bibbins—General Electric Company, San Francisco.
H. D. Brainard—Western Electric Company, Seattle.
T. E. Burger—Western Electric Company, Los Angeles.
H. V. Carter—Pacific States Electric Company, San Francisco.
J. M. Chamberlin—Fobes Supply Company, Portland.
John R. Cole—Harvey Hubbell Company, San Francisco.
Albert H. Elliot—Secretary, San Francisco.
D. F. Fearing—National Carbon Company, Cleveland.
S. B. Gregory—Arrow Electric Company, San Francisco.
C. B. Hall—Illinois Electric Company, Los Angeles.
H. B. Hall—Pass & Seymour, San Francisco.
A. H. Halloran—Journal of Electricity, Power and Gas, San Francisco.
C. C. Hillis—Electric Appliance Company, San Francisco.
E. A. Hunt—General Electric Company, San Francisco.
R. D. Holabird—Holabird Reynolds Company, San Francisco.
F. M. Killam—Pacific States Electric Company, Seattle.
A. S. Moody—General Electric Company, Portland.
F. H. Murray—National Carbon Company, Los Angeles.
J. F. Ryan—Western Electric Company, Portland.
H. E. Sanderson—Bryant Electric Company, San Francisco.
C. N. Sampson—American Steel Products Company, Portland.
A. J. Selzer—Adams-Bagnell Company, Chicago.
F. F. Skeel—Crouse-Hinds Company, Chicago.
Miles F. Steel—Benjamin Electric Company, San Francisco.
C. E. Wiggin—Dunham, Carrigan & Hayden, San Francisco.
Garnett Young—Telephone Electric Equipment Company, San Francisco.



JOURNAL OF ELECTRICITY
POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1890.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Pacific Coast Gas Association Convention

If any evidence were necessary to prove that the success of a convention does not hinge upon the large volume of business transacted or the total registration, it would be but a simple matter to point to the performance of the Pacific Coast Gas Association at their Twenty-first Annual Convention, which has just become history.

Climatic conditions, high temperatures, were against them, but fortunately those in charge of arrangements had provided a properly ventilated hall having good acoustic properties, and this, together with a careful selection of those to read papers, eliminated the soporific element usually associated with conventions, while the intense interest which maintained practically 100 per cent attendance and which occasionally left men on their feet eager to continue discussion when the allotted time had expired, achieved an unprecedented success.

The papers presented were of a high standard, yet were of great interest to all because they were invariably expressed in terms which all could understand. The discussions were not of disagreement, but of corroboration. Hearty good-fellowship prevailed all round and the willingness of representatives of manufacturers to co-operate was everywhere evident.

One man with understanding may perform more than myriads ignorant, a small organization imbued with enthusiasm and properly guided may outstrip the larger organizations in excellent performance, and quality was ever better than quantity; live men better than dead ones.

The convention has passed and left many good ideas to ponder over. The Pacific Coast Gas Association meets again in convention in 1914 at Long Beach, Cal., these ideas will grow and perhaps be expressed there in their maturity.

In the interim, much work is to be accomplished and each individual must take up again his several tasks which stand not only for immediate performance but for the progress of the gas industry.

Oregon Commission Regulations

The Railroad Commission of Oregon has published its general regulations governing overhead and underground construction of telegraph, telephone, signal, trolley and power lines. Aside from a few minor changes they are the same as the tentative regulations as published in this journal on August 9, 1913, and are nearly identical with those of California. One addition is the requirement that underground tubes or conduits entering buildings shall be tightly closed at outlets to prevent gases from entering the building. Several slight changes in the clearance specifications have been made and a new specification for "power lines of more than 600 volts and less than 5000 volts" has been much adopted as

regards minimum size of wire for crossing, though this same distinction is not held as regards clearance.

This order exhibits a characteristic feature of a great majority of commission rulings, an evident spirit of fair play. It has been promulgated only after conference with all interested parties and embodies the best thought available on the subject. Contrary to the popular idea public service commissions have powers which far transcend the mere fixing of rates, and these bodies should be instrumental in improving the service and enhancing the safety of all utilities over which they have jurisdiction.

A Western Utility Association

Grave problems confront the managers of Pacific Coast public utilities. While to a large extent each man must work out his own solution, certain common factors may be applied to reduce these problems to simpler terms. But to discover these points in common it is necessary to get together frequently. With the present multiplicity of organizations we hesitate to suggest another, but the need warrants the formation of a Pacific Coast public utility association.

The fact that Western conditions are different from Eastern, while difficult for our Eastern friends to understand, is borne out by experience. High head water plants, long distance transmission lines or fuel oil cannot be successfully applied by engineers who do not understand the conditions peculiar to each locality. Witness the recent failure of a dam and destruction of a power plant constructed under the direction of the engineer for an Eastern financial house, the advice of experienced local engineers to the contrary, notwithstanding!

Nor are engineering conditions all that are different. Business methods in the West are as unlike those in the East as are the habits of the two peoples. Why attempt a house-wiring campaign in a community where ninety-eight per cent of the houses are already wired? What success would the average central station solicitor have in inducing a farmer to irrigate his crops by means of electric pumping? How much reliance will a lumberman or a mining superintendent place in the statements of a man who attempts to electrify these industries by correspondence from an office in New York City? Yet men on the ground have already made the per capita consumption of electricity in Western states exceed that in any of the Eastern.

The creation of a market for surplus electric power is a subject now engaging the attention of many of the larger electric companies. Population has not kept pace with power development and new industrial uses are being investigated as possible consumers of available power. Several of the companies have gone to considerable expense in sending representatives to study the conditions of various foreign industries with the thought of their adaptation to local conditions. Such work could be better accomplished by an association and the results given to all members. For example, selling off-peak current for the utilization of atmospheric nitrogen has long been the dream of the power man. When it is considered that nitrogen is one of the most abundant and yet one of the most expensive elements when put into saleable combinations, the possibilities of its effect on the electrical business are incalculable. Nitrogen has the singular property of being a most inert element as a diluent of the air, but a most active component of explosives or the poisonous alkaloids. Though there are about twenty tons of atmospheric nitrogen over every square mile of the earth's surface, until recently it has been directly used only by a few plants. Here it is that the puny strength of the tiny microbe is more powerful than the mighty force of lightning in causing combination. Several methods of electrical fixation have been successfully applied in Europe, but present rates on the Pacific Coast are not yet low enough to attract this industry.

Public policies also differ. The present trend of public sentiment in the West is toward municipal ownership. Where its manifest advantages can be combined with those of private operation there is a strong likelihood that many corporate organizations will become operators of systems leased from municipalities. A publicity campaign is necessary to educate the people, literally "to lead their minds into proper channels," both as regards political operation of public utilities and as concerns ill-advised competition in communities which are already adequately served. This should be directed by those in touch with the local situation in order that it may be truly effective.

Finally there is need of concerted action and a fixed policy regarding relations with employes. Where operators of public utilities are responsible to the public for a safe and efficient service, they should have full discretion in passing upon the competency of the men performing their work and of the conditions under which the work is done. Such action should be in direct accord with the beneficent principles of trade unionism but should in no way allow interference with the conduct of a business upon which the public is so vitally dependent for its utilities. This question can be satisfactorily handled only through a central office where the policy is judiciously determined and put into execution.

While all these various matters are broadly treated by the national associations, an annual meeting in some far-away city is no place to discuss problems of local interest. Some intimate, unified Pacific Coast association is necessary to handle the peculiar conditions existing in this territory. Whether this be a strong branch of a national body with local officers, as has been done by the Pacific Coast Electric Railway Association, or whether it be an independent organization, is immaterial. The great need is for action, and that at once.

Clear-eyed men of vision see a great empire from the "Rockies to the Coast" which will come into its own with the completion of the Panama Canal. Present problems will then be intensified and it consequently behooves the men whose duty it will be to supply the public utilities to this great population to get together now and prepare for the future.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

K. G. Dunn, of Hunt, Mirk & Company, San Francisco, is in Southern California on a business trip.

L. F. Yandall, Electrical Machinery & Equipment Company, Stockton, Cal., was at San Francisco this week.

George S. Nickerson, civil and hydraulic engineer of Sacramento, was at San Francisco during the past week.

W. S. Post, engineer for the Cuyumaca Water Company of San Diego, was a recent visitor in San Francisco.

H. N. Lauritzen, Pacific Coast manager for the Holophane Works of the General Electric Company, is at Los Angeles.

Frank B. Rae of New York, formerly publisher of Electrical Merchandising, paid a short visit to San Francisco last week.

T. E. Blake, manager of Hawaiian Electric Company, Honolulu, recently spent a few days at San Francisco, on his way East.

F. E. Blake, manager of the Hawaiian Electric Company, is spending a week in San Francisco, while on a vacation trip to the East.

F. F. Skeel, western manager for the Crouse-Hinds Company, is visiting the Pacific Coast, being expected in San Francisco during the next week.

E. M. Cutting returned this week from Sacramento, where he has been conducting a display at the State Fair for the Edison Storage Battery Supply Company.

John A. Britton, president of the Pacific Gas & Electric Company, of San Francisco, left for Washington, D. C., and an extended trip East the first part of the week.

H. C. Goldrick, Pacific Coast sales manager, Kellogg Switchboard & Supply Company, is in the Northwest on a business trip and will return to San Francisco next week.

C. B. Babcock, Paul Hough, R. J. Thompson, B. M. Pederson and **H. P. Pitts** were appointed a committee on Gas Exhibits at the San Jose convention to look after the novelty part of the association's work in the future.

L. Gaertner recently resigned as manager of the San Francisco branch of the Interstate Electrical Novelty Company to engage in business for himself as secretary of the Beacon Miniature Electric Company of New York.

Roger Kemp, manager of Montana Electric Supply Company at Butte, Montana, died Sept. 17th. Mr. Kemp was one of the most popular electrical men in Montana. His death has come as a severe shock to his many friends in the West.

O. C. Merrill, chief engineer of the U. S. Forest Service, whose headquarters are in Washington, D. C., has just returned to Washington from San Francisco via Portland. While in California Mr. Merrill made several filed trips accompanied by District Engineer Fowler.

H. V. Carter, president of the Pacific States Electric Company, San Francisco, has extended his visit to the recent Jobbers' Convention at Portland, to Seattle and the Northwest and contemplates spending a several days' trip in that region.

C. B. Hawley, president and general manager of the Intermountain Electric Company, Salt Lake City, has returned from an extended trip to the East where he attended the convention of the National Electrical Contractors. Mr. Hawley was accompanied by his family, and combined much sightseeing with his business.

J. E. McDonald, secretary Joint Pole Committee, Los Angeles, **Royal W. Sorensen**, Professor of Electrical Engineering, Throop Polytechnic Institute, Pasadena, Cal., and **Victor A. Dorszeski**, electrical engineer Portland, have been transferred to the grade of member in the American Institute of Electrical Engineers.

Carl D. Schluederberg, manager of the switchboard sales department of the Westinghouse Electric & Manufacturing Company, is spending a few days at Salt Lake City getting in touch with the local conditions. This is is Mr. Schluederberg's first trip west of Chicago, and he is very favorably impressed with the rapid strides which have been made in electrical development in the West during the past few years.

S. R. Inch, general superintendent of the Utah Power & Light Company, and **G. B. Thomas**, auditor for the company, have returned from Boise, Idaho, where they went with **P. B. Sawyer**, general manager, on a business trip. Speaking of conditions as he found them in Idaho, Mr. Inch reports: "Generally things seem to be in good shape. Everybody talks about big crops and good business. Our company has nothing at Boise, but the companies operating there report considerable activity. Boise is prosperous and the city looks fine. Along the line the little towns also appear to be in a flourishing condition. Of course there is little between Pocatello and Nampa but sagebrush and desert, but even that seems to be a country of great future opportunities. This side of Pocatello agricultural conditions are promising."

R. R. Tour, the new instructor in Gas Engineering at the University of California, graduated from the University of Michigan in 1910, getting the degree of B. S. in Chemical Engineering. During the following year he held the Fellowship in Gas Engineering, given by the Michigan Gas Association. After serving for a time as the superintendent's assistant in the employ of the Consolidated Gas Company of New York, he was made assistant superintendent of the plant at Astoria, L. I., which position he resigned to accept his present one. This position was created by the Pacific Coast Gas Association, the course in gas engineering having been started the first of the year by Prof. Sibley and supplemented by lectures from John A. Britton and E. C. Jones. The new course opened with eighteen students and bids fair to become a leading factor in the Mechanics Department.

Harry J. Billica, Washington Water Power Company, Spokane, **Louis N. Brodens**, electrical engineer, E. H. Heaps & Company, Vancouver, B. C., **Thomas Burns**, construction electrical engineer, Prince Rupert Hydroelectric Company, Ltd., Prince Rupert, B. C., **T. F. Copeland Jr.**, electrical engineer, Pacific Gas & Electric Company, San Francisco, **C. H. Fletcher**, city electrician, Vancouver, B. C., **W. H. Fribley**, superintendent of construction, Raymond, Wash., **J. I. Kohn**, draftsman, Pacific Gas & Electric Company, San Francisco, **R. P. Lutzi**, electrical engineer, Pacific Gas & Electric Company, San Francisco, **R. L. Martin**, electrical engineer, Western States Gas & Electric Company, Richmond, Cal., **K. H. R. McGuinn**, engineer of underground construction, Western Canada Power Company, Ltd., Vancouver, B. C., **L. N. Peart**, general superintendent, San Joaquin Light & Power Corporation, Fresno, Cal., **L. F. Rawden**, municipal electrician, South Vancouver, B. C., **E. N. Ridley**, telephone salesman, Northern Electrical & Manufacturing Company, Vancouver, B. C., **Eric Therkelsen**, engineering instructor, University of Washington, Seattle, **W. L. Wales**, chief engineer Yolo County Consolidated Water Company, Woodland, Cal., and **Frank G. Whitney**, wire chief, Pacific Telephone & Telegraph Company, Los Angeles, have been elected associates in the American Institute of Electrical Engineers.

MEETING NOTICES.

Jovian Electrical League of Southern California.

Mayor H. H. Rose addressed the Jovian Electrical League of Southern California at their regular meeting Wednesday, September 24th, at Christophers.

Electrical Development and Jovian League.

Tuesday, Sept. 23, was Jovian day and under the able leadership of Alternate Statesman W. W. Hanscom a pleasant

hour was spent with moving pictures and moving stories at Tait's cafe. The prize for the best story was awarded to Tom Collins and for the best song to Ralph Phelps.

Oregon Society Engineers.

The following committee of the Oregon Society of Engineers has been appointed to investigate the need for a "Joint Pole Committee" in Portland. They will also recommend to the Society, the best means of establishing a commission in Portland. Following is the personnel: R. Z. Young, B. C. Condit, H. A. Kirkland, O. B. Coldwell, and F. D. Weber.

Los Angeles A. I. E. E.

The Los Angeles Section of the American Institute of Electrical Engineers celebrated the opening of the fall season on September 25th with a reception and dinner to Ralph W. Pope, honorary secretary and F. L. Hutchinson, secretary A. I. E. E., at the Union League Club, Second and Hill streets. A report of the Pacific Coast Meeting at Vancouver, B. C., was made and an enjoyable evening spent.

San Francisco Section A. I. E. E.

The first meeting of the San Francisco Section for the season of 1913, was held Friday, September 26, 1913, at 8 p.m., in Native Sons Hall. Mr. W. L. R. Emmett of the General Electric Company, addressed the Section on the subject, "Electric Propulsion of the U. S. Collier 'Jupiter,'" which was thoroughly enjoyed by all present. This vessel was recently tested and made a creditable showing. More thorough tests will be made later. The results are being watched with much interest.

Street Railway Employes' Convention.

The convention of the Amalgamated Association of Street Railway Employes of America adjourned on the 17th inst., and in spite of the strenuous efforts of C. O. Pratt to have the Philadelphia local reinstated, adjournment was held without taking favorable action on their petition. The controversy took a new turn the day following the adjournment of the convention when Mr. Pratt succeeded in having a writ of mandate served on the officers of the association requiring their presence before Judge M. L. Ritchie in the district court to show cause why Pratt and his Philadelphia associates should not be reinstated.

Utah Society of Engineers.

The first fall meeting of the Utah Society of Engineers of Salt Lake City was held in the Stock Exchange Building on the 20th inst. Mr. A. H. Thiessen, section director of the United States weather bureau, delivered the first paper of the evening dealing with atmospheric conditions and their effect on the smoke nuisance. O. W. Ott, consulting engineer, read an extensive and interesting paper on the smoke nuisance explaining the causes and methods of minimizing the smoke generated by combustion. Professor E. H. Beckstrand of the University of Utah, submitted statistics indicating that about forty tons of soot are spread over the city daily during the winter months as a result of the improper firing of furnaces. George H. Dern, chairman of the Commercial Club special committee, Dr. Samuel G. Paul, health commissioner, W. H. Bywater, chief of the fire department, and Mr. Drake of the National Association of Stationary Engineers, joined in the discussion which followed the reading of the papers.

TRADE NOTES.

The Ohio Brass Company announces that it is now in position to furnish with pin driven terminals all forms of its all-wire bonds which were previously furnished with compressed terminals.

The Seattle office of the General Electric Company has sold a 1000 kw. turbine generator with switchboards and Wheeler surface condenser to the Alaska Treadwell Gold Mining Company of Juneau, Alaska.

Pierson, Roeding & Co., San Francisco, announce the change of location of the business office of the Safety Insulated Wire & Cable Company from 589 Howard street to 118 New Montgomery street, the headquarters of the former concern.

The Holtzer-Cabot Electric Company has just issued an interesting pamphlet devoted to electric fire alarm systems for schools. The booklet contains illustrations of several types of apparatus, also wiring diagrams for typical installations.

NePage, McKenny & Company have been awarded the contract for complete electrical installations in the eight story Pittock Block being erected for the Northwestern Light & Power Company. The contract amounts to approximately $16,000.

"Motor Drive in the Silk Industry," "Selecting Motor Equipment for Electrically Operated Hoists," "Motors for Intertype and Linotype Machines," and "Alternating-Current Magnet Switches" are the titles of pamphlets and leaflets recently issued by Westinghouse Electric & Manufacturing Company.

The general Gas Light Company, Kalamazoo, Mich, is distributing a neat folder, The Guide by Night, devoted to Humphrey Gas Arc Lamps. This company has also recently issued a supplementary data sheet showing plan, elevation, and test data on an installation of these arcs in a wholesale millinery goods show room.

MANUFACTURERS' EXHIBIT, PACIFIC COAST GAS ASSOCIATION CONVENTION.

One of the contributing factors to the great success of the convention was the manufacturers' exhibit on the ground floor of the convention building, which merited all the interest shown by both the public and the visiting delegates. The representatives of the manufacturers spared no effort in making the displays at once unique, comparatively complete, novel and attractive.

The Pacific Gas and Electric Company used the daily papers as a means of inducing the public to attend the exhibits, and added to the interest by giving a magnificent gas range to the visitor holding the lucky number.

The Welsbach Company showed a new line of units using the Reflex 20, a burner designed to compete with high power Mazda lamps; a new semi-indirect unit of artistic and attractive lines, and the Ives Daylight Producer, a new incandescent gas mantle color matching lamp of marked merit.

The General Gas Light Company showed a complete line of gas arcs both for interior and exterior installation; also street light standards installed alongside the regulation electric light standard for comparison.

The Clark Stove Manufacturing Company, Walker Stove and Range Company, W. F. Boardman Company, and the Trenkamp Stove Company each exhibited a nice line of stoves, some having novel features.

Rector System Gas Heating Company, San Francisco, Cal., had a working exhibit of their gas radiators. This system seems to be increasing in popularity on account of its many excellent features, such as ease of control and so on.

An exhibit of pipe fittings and other similar lines was displayed by the H. Mueller Manufacturing Company. The Ruud system of water heating was also shown.

Last but by no means least was the exhibit of the Davis Meter Company of San Diego, Cal., showing the construction of their gas meters.

A continual round of demonstration and a large number of photographs showing the many new applications of gas for industrial fuel aided in rounding out the success of the manufacturers' effort.

INDUSTRIAL

NECESSARY OFFICE VENTILATION AT SMALL EXPENSE

Every grown person needs 3600 cubic feet of fresh air every hour! Without this amount of pure air, any man or woman labors under an unnecessary burden that lowers the vitality and reduces the efficiency for accuracy work by an amount proportional to the decrease in the air supply.

Take the case of an office 14 by 20 ft. and 11 ft. high, which contains about 3080 cubic feet of air. To supply each of four occupants with 3600 cubic feet of fresh air per hour, the air must be completely renewed about six times per hour or a little oftener than once every ten minutes. It is evident that it would take a pretty stiff draft blowing through a 5 ft. window raised 3 inches to secure this ventilation. In the winter, coat collars would be turned up, fur collars put on, and there would be four pairs of cold feet. But ventilation can be secured without cooling the room.

If a small motor-driven blower is arranged with a few short pieces of piping so that fresh air is drawn from the outside and delivered against a steam radiator, the air will be warmed and delivered in a gentle current which will not cause any one to be uncomfortable and yet the room will be warm and the air fresh.

Office Ventilating Set.

Such an arrangement is shown in the illustration, where a Westinghouse motor driving a Sirocco blower is mounted on a stand directly over a steam radiator. The intake of the blower is piped with a gate between it and the board set in the window to give access to the outside air; the outlet delivers the air at the top of the radiator. The air is prevented from blowing along the floor by a galvanized iron box which surrounds the radiator on all four sides, extending from the floor to the top of the radiator but open at the top. Thus the cold air is delivered at the top of the radiator in a downward current, and before it can find its way out of the box again, it must rise around the radiator and become warmed. The blower shown is capable of supplying 175 cubic feet of air per minute, or 10,500 cubic feet per hour, a sufficient supply for three persons. The natural ventilation provided through the opening of doors, around the edges of the windows, and in other ways is sufficient for an additional person.

It should be remembered that the action of the blower will be to stimulate the action of the radiator; the cold air cools the radiator, condenses the steam and causes fresh steam to enter; thus increasing the circulation of steam and causing the radiator to give out more heat.

LIGHTING THE MODERN CIRCUS.

One of the latest provinces wherein electricity furnishes light at night is under the big canvases of the great modern circus, a veritable city that is always on the move and must therefore be completely self-contained and portable. Open flame gasoline torches or gas lamps have lighted circuses for many years; but this season two of the largest tent shows in the world, Barnum & Bailey and Ringling Bros., are equipped with their own power plants for lighting the big top and smaller tents by electricity.

The apparatus consists of 25 kw. portable gasolene-electric sets manufactured by the General Electric Company specially for the purpose. The units are carried in duplicate, two sets for each circus, so that if one should, by any chance, become disabled while enroute, the other can supply current for half the lights. They are arranged, however, to operate regularly in multiple, each set furnishing current for eighteen arc lamps, which totals thirty-six of these lamps for lighting a show. Two 25 ampere spot lights for the stage and several strings of incandescent lamps are also operated from the plants in each instance. A third supply wagon used for a workshop accompanies the outfits and has a powerful electric searchlight mounted on top, which is directed to different parts of the grounds while taking down tents and loading after the evening performance.

The outfits are compactly built and are readily portable. They are mounted on one of the ordinary enclosed circus wagons, about 18 ft. long and 7 ft. wide, with the ends and sides of the truck body removable. Each unit is composed of a 25 kw., 125 volt, compound wound, direct current generator, which is built integral with the frame and direct connected to the shaft of a four-cylinder, four-stroke cycle, 560 r.p.m., throttle-governed, vertical gasoline engine.

The set is installed on the rear of the wagon with the flywheel at the outer end. The switchboard for controlling the current is located about two feet from the generator end of the unit. This is of the slate panel type with main and feeder switches, instruments, rheostats, etc. At the front of the truck is installed the cooling system for the engine. It consists of a pressed steel radiator having a 320-foot radiating surface, which is cooled by two motor-driven fans. A 65-gallon, cylindrically shaped water tank is mounted directly over the radiator. The gasolene supply tank, holding twenty gallons, and engine muffler are suspended underneath the wagon. The tents are all equipped with protected wiring that can be easily and quickly installed and removed each time the tents are erected and taken down.

Ignition is effected by a low-tension, automobile type magneto and induction coil, with an auxiliary battery for starting. The governor is very sensitive and responds instantly to changes in load. It limits the speed variation of the engine from no load to full load within 4 per cent, which with the type of generator employed insures constant voltage. Adequate lubrication is secured by forced circulation from an oil pump.

The generator is one of the latest multipolar continuous current machines, designed especially to meet the characteristics of the engine to which it is connected. The field winding is compounded and compensates for the drop in engine speed between no load and full load, thereby maintaining a constant voltage throughout the entire range of operation. All similar parts of these outfits are built so that they are readily interchangeable in so far as is mechanically practicable, which allows replacing with renewals without tedious fitting.

NEWS NOTES

INCORPORATIONS.

BOISE, IDAHO.—Articles of incorporation have been filed for the Adams County Light & Power Company of New Meadows, capitalized at $200,000. This is the same company that has asked the public utilities commission for a permit to give electric service to Meadows, New Meadows, Council, Cambridge and other towns. The incorporators are: B. Gastad, N. Gastad, W. H. Hall, Eugene Enloe and W. N. Scales.

ILLUMINATION.

BREMERTON, WASH.—The voters of Bremerton last week voted against the municipal light plant.

ALBANY, ORE.—C. L. Rauch and associates of Albany will request a new gas franchise from the city.

BAKER CITY, ORE.—The city council has passed an ordinance ordering the sale of the $25,000 bonds for the new municipal light plant. Steps to insure the actual construction of the plant will be taken as soon as possible.

SAN BERNARDINO, CAL.—Mayor J. W. Catick has announced plans for municipal improvement, which will include bond issue of about $300,000. It is proposed that the city acquire the electric light plant, and electric street railway.

GLENDORA, CAL.—Bids will be received in about 60 days for installing a lighting system for this city, consisting of 210 ornamental lighting posts and several miles of conduits, together with junction boxes, conduit boxes and time switch controls.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has been instructed to light and maintain electroliers on Polk street, between Sutter and Pacific avenue and on Mason street between Post and Turk streets and to remove the gas lamps at those locations.

PALO ALTO, CAL.—District Attorney Swart has approved the petition asking for the establishment of a highway lighting district comprising the Denniston voting precinct and it has been ordered that an election be called to permit the citizens to vote on the question.

GALLUP, N. M.—A resolution has been adopted by this city calling a special election to be held on October 7th, for the purpose of submitting to the voters the franchise applied for by the Peoples Light & Power Company to construct and operate an electric light plant within the corporate limits of Gallup.

LOS ANGELES, CAL.—The Board of Public Works and Acting Mayor Whiffon at a conference with the city auditor completed arrangements whereby $25,000 per month will be advanced for three months out of the general fund for completing the aqueduct power house and getting about $1,000,000 worth of electrical machinery hauled before the rainy season begins.

PASADENA, CAL.—Resolutions have been adopted by the commissioners of the city of Pasadena declaring intention to order construction and installation of lights, posts, wires, pipes, lamps, and other necessary appliance for lighting Waverly and Bellevue Drives between Pasadena and Orange Grove avenues, in accordance with plans and specifications and resolution requirements.

PROVO, UTAH.—The representatives of the Utah Gas & Power Company, who are installing a gas plant in this city, appeared before the city commissioners and asked that action be deferred until November first on the signing of contracts for Provo's proposed Great White Way. The company represented that by that date it would have its plant in shape to enter the field for supplying the required light.

SOUTH VANCOUVER, B. C.—Mr. Rawden's report to the council on municipal electric plant estimated that a thoroughly modern crude oil plant would cost $400,000. The second unit would cost $200,000. Mr. Rawden states that the plant could produce light and power by day and sell this to the consumers for two cents a kilowatt hour. At night the current could be sold for between 7 and 8 cents per kw.-hr.

SAN FRANCISCO, CAL.—The following bids were received for complete electric work on the new city auditorium: The Turner Company, $21,445; Rex Electrical Construction Company, $28,787; Decker Electric Company, $21,489; Standard Electrical Construction Company, $22,774; A. E. Brook Ridley, $22,793; Globe Electrical Works, $27,965; H. S. Tittle, $20,500; McFell Electric Company, $22,585; Newberry-Bendheim Company, $17,400; Butte Engineering & Electric Company, $22,500; Bay Counties Electric Construction Company, $43,500.

COVINA, CAL.—The following bids were received for center street ornamental lighting system. The total length of frontage is 3645.65 ft., requiring 42 posts and 7980 ft. of conduit:

Newberry, Bendheim Electric Company	$3974.00
K. T. Bennett, Los Angeles, Cal	4455.00
Granger Hall Electric Company, Ontario, Cal	4600.00
Woodill Hulse Electric Company	4730.81
Geo. R. Albers, Covina, Cal	4994.00
Pacific Underground Construction Co., Las Angeles, Cal.	5092.29
John C. Jacobs, Pasadena, Cal	5249.00
E. L. McEwan, Ocean Park, Cal	7337.40
Estimated by F. G. Dessery	4263.00

The contract was awarded to the Newberry, Bendheim Electric Company, at $3974.00.

SAN FRANCISCO, CAL.—The state commission has instituted an investigation into the wholesale price of natural gas in Los Angeles County. The matter was brought to the attention of the commission by a resolution of the city council of Los Angeles, asking the commission to establish a price which producing and pipe line companies should be allowed to charge distributing companies for the natural gas product. Natural gas was recently introduced into Los Angeles county, carried by pipe lines from the Kern county fields. The gas is sold at wholesale outside the city limits of Los Angeles to the distributing companies, which retail it within the limits of the city. The commission's jurisdiction has arisen from the fact that the gas is sold by the producing and pipe line companies to the distributing compaules at a point outside the city limits of Los Angeles. The rates within the city of Los Angeles have become a subject of controversy, and on this matter the city authorities of Los Angeles desired that a wholesale rate be first established.

TRANSMISSION.

SAN FRANCISCO, CAL.—The application of the Power & Irrigation Company of Clear Lake to the State Water Commission for a permit to appropriate the waters of Clear Lake for the generation of electricity has been denied.

BELLINGHAM, WASH.—The Sumas Electric Light Company, Sumas, Wash., has filed application with the county auditor for a franchise to construct and operate transmission lines for electric power and light, as well as for a telephone line along the county roads of Whatcom County.

MONTESANO, WASH.—The Elma Light & Power Company, Elma, Wash., has filed application for a franchise to construct and maintain a line of poles and wires to furnish electric current along the county road. October 6th has been set as the date for the hearing of this question.

SALT LAKE CITY, UTAH.—Notice has been received by the local United States Land Office of the withdrawal from settlement, location, sale or entry of approximately 2670 acres of land in Blacksmith Fork Canyon, Cache County, Utah. The land is now included in land reservation No. 393, and will be utilized as water power sites.

LOS ANGELES, CAL.—Officials of the Pacific Light & Power Corporation will appear before the State Railroad Commission to make formal application for permission to issue $52,300 in stocks and $1,730,000 in bonds.; $497,000 of the bond proceeds are to be used to refund underlying bonds, and the balance, $1,243,000 will be used in connection with the Big Creek and other hydroelectric projects of the company.

LYLE, WASH.—An important step in the final disposition of the water power question was made here in the transfer of all the Ham, Yearsley and Ryrie interests on the Klickitat River to Edgar A. Torrance, a representative of the Northern Pacific Railway Company. A clause in the transfer prevents the construction of a dam at the point where such work was originally begun by the Northwestern Electric Company before their withdrawal from the field was forced.

ELY, NEVADA.—Preparations are being made on Illipah Creek about 30 miles west of Ely for the erection of a power plant to supply Hamilton and the White Pine mining district with electric current for power and lighting purposes by the Hamilton Power, Mining & Transportation Company, which is controlled by residents of McGill. Surveys and calculations made by the company engineers show that 340 h.p. can be generated on Illipah Creek aboout 6½ miles from Hamilton. The plant will cost more than $30,000. Construction will be started shortly.

SAN FRANCISCO, CAL.—The Oro Electric Corporation has appealed to the supreme court of California from the decision of the railroad commission refusing it permission to enter Stockton. The chief ground of the appeal is that the municipality of Stockton granted the company a franchise to carry on its business there. The contention is made that cities like Stockton have the right to choose whether or not they desire competition, and, having decided that they do, that it does not lie within the power of the commission to deny the company entrance to the city.

LOS ANGELES, CAL.—Suit has been filed in the United States court by George J. Henry Jr., against the city of Los Angeles for infringement of patent. The complainant alleges that the city has infringed and is infringing this patent at present. The infringement consists in the use of certain apparatus for developing power on the line of the Los Angeles aqueduct and the matter is believed to be of extreme importance because of the prospects of development of power in the future upon a large scale, by converting the energy of the flowing aqueduct waters into electricity. The suit was brought through Attorney Raymond Ives Blakeslee.

PORTLAND, ORE.—Co-operation between the state governments of Oregon and Washington and the War and Interior departments of the federal government will be sought by the committee created by the Oregon Legislature to determine the feasibility of, and to outline plans for, the construction of a publicly-owned hydroelectric power project on the Columbia River near the Big Eddy rapids. The commission met informally this week with Vernon A. Forbes of Bend and J. D. Abbott of Portland, members of the lower house of the legislature; I. N. Day of Portland, state senator, and John H. Lewis, state engineer, present. On account of the absence of Senator J. C. Smith of Grants Pass the fifth member, the committee did not organize.

TRANSPORTATION.

SAN FRANCISCO, CAL.—The supervisors at their last meeting adopted a resolution, recommended by the Lands and Tunnels Committee, Supervisor Mauzy, chairman, abandoning the proceedings looking toward the construction of a tunnel in Fillmore street.

OGDEN, UTAH.—The directors of the Ogden Rapid Transit Company have instructed Manager P. D. Kline to commence the work of double tracking the Washington avenue line between Twenty-eighth and Thirty-second streets. The company expects to have this work completed by the first of November.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has surveyors in the field laying the preliminary lines for the proposed extension of their suburban line from Holiday to Big Cottonwood Canyon along the county road. This canyon boasts as fine scenery as any in the Wasatch range.

SEATTLE, WASH.—Bids will be received by W. D. Freeman, purchasing agent of the city of Seattle, until October 1, for supplying cross arms, braces, insulators, and other material for feeder and trolley construction, exclusive of conducting wire, for the Seattle Municipal Street Railway, in accordance with plans and specifications approved by the board of public works.

PORTLAND, ORE.—S. S. Bullis of New York has secured a heavy interest in the well-known Standard mine of Jackson County, Ore., and is installing a 450 k.v.a., 6600 volt, 3-phase, 60 cycle Bullock generator to be direct connected to a Worthington turbine, for mine purposes, also to supply electric energy for a Medford trolley system. It is the intention to extend this to an interurban system linking up the towns of Medford, Ashland, and Jacksonville. Street excavation in Medford for track laying is under way.

HANFORD, CAL.—F. S. Granger, the promoter of the Fresno, Hanford & Summit Lake Railroad, has severed his connection with the company and has disposed of his interest in the interurban line to John S. Somers, an Oakland broker, who purchased the stock for L. H. Jones, a civil engineer and his associates. Granger, having sold his stock, steps out as president, manager and director of the road and is succeeded as director by Somers and as manager by Jones. A. B. Clark, the vice-president, will act as temporary president until the company is reorganized.

TELEPHONE AND TELEGRAPH.

REEDLEY, CAL.—In order to provide more suitable quarters in which to house its central office, apparatus, the Reedley Telephone Company has made arrangements to lease a new building about to be erected for it on Eleventh street, between F and G.

GLENDIVE, MONT.—C. A. Rasmussen of the executive committee of the Pioneer Telephone Company, awarded the contract to Frank O'Malley for the construction work on 63 miles of the proposed line, the first unit of the company's projected line to Jordan.

PORTLAND, ORE.—Expenditures aggregating approximately $150,000 have been authorized by the Pacific Telephone & Telegraph Company to provide for increased business in Portland and immediate vicinity. Included in the work thus provided for are new poles and cable lines in Portland Heights and vicinity, long distance lines between Portland, Aurora and Salem and a new conduit in Montavilla.

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

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Batteries
Edison Storage Battery Co.

Boiler Feed Water Treatment
Dearborn Chemical Co.

Conduits
Sprague Electric Works

Condulets
Crouse-Hinds Co.

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Weston Electrical Instrument Co.

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Habirshaw Wire Co.
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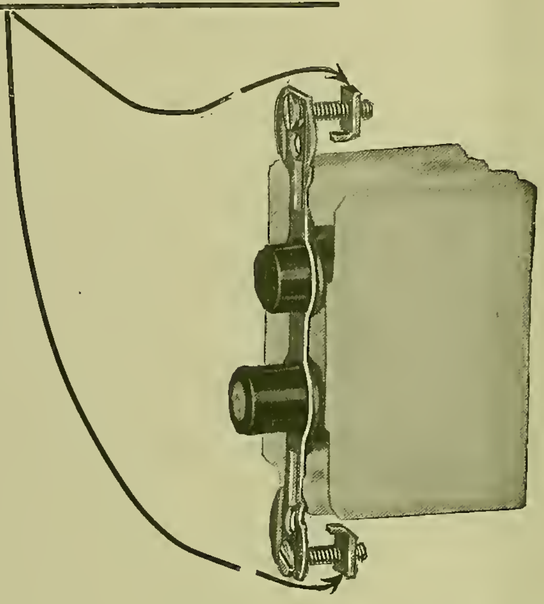
Alphabetical Index to Advertisers, Page 8. **Where to Buy It in the West, Pages. 9, 10.**

THESE ARE THE VANTAGE POINTS



OF

SWITCHES

The adjusting nuts with which all G-E switches are provided, eliminates the nuisance, loss of time and labor entailed by the old method of using washers to flush the box with the wall.

This is only one of many dependable wiring devices carried by us and designed to give high efficiency and economy not only during installation but in every day service.

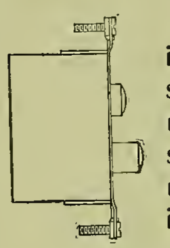
Write and have us demonstrate their installation to you.

Pacific States Electric Co.

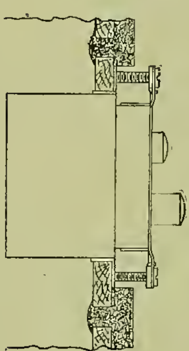
The Modern Electrical Supply House

Distributors for the Pacific Coast

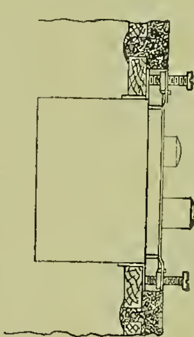
SAN FRANCISCO OAKLAND LOS ANGELES
PORTLAND SEATTLE



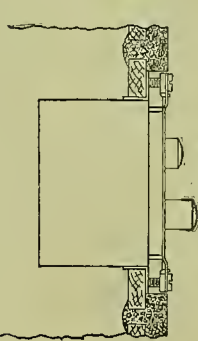
FIRST—Place the screws in the inside holes in the switch support and run the nuts on until they clamp the support. The lugs on the nuts to be in the inside holes in the support.



SECOND—Place the switch in the outlet box with the points of the screws in the threaded holes in the outlet box ears.



THIRD—Back out the screws, at the same time pressing inward on the switch, until the switch supports are flush with the surface of the plaster.



FOURTH—Turn the screws forward so they will enter the threaded holes in the outlet box, and tighten up.

JOURNAL OF ELECTRICITY
POWER AND GAS
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VOLUME XXXI — SAN FRANCISCO, OCTOBER 4, 1913 — NUMBER 14

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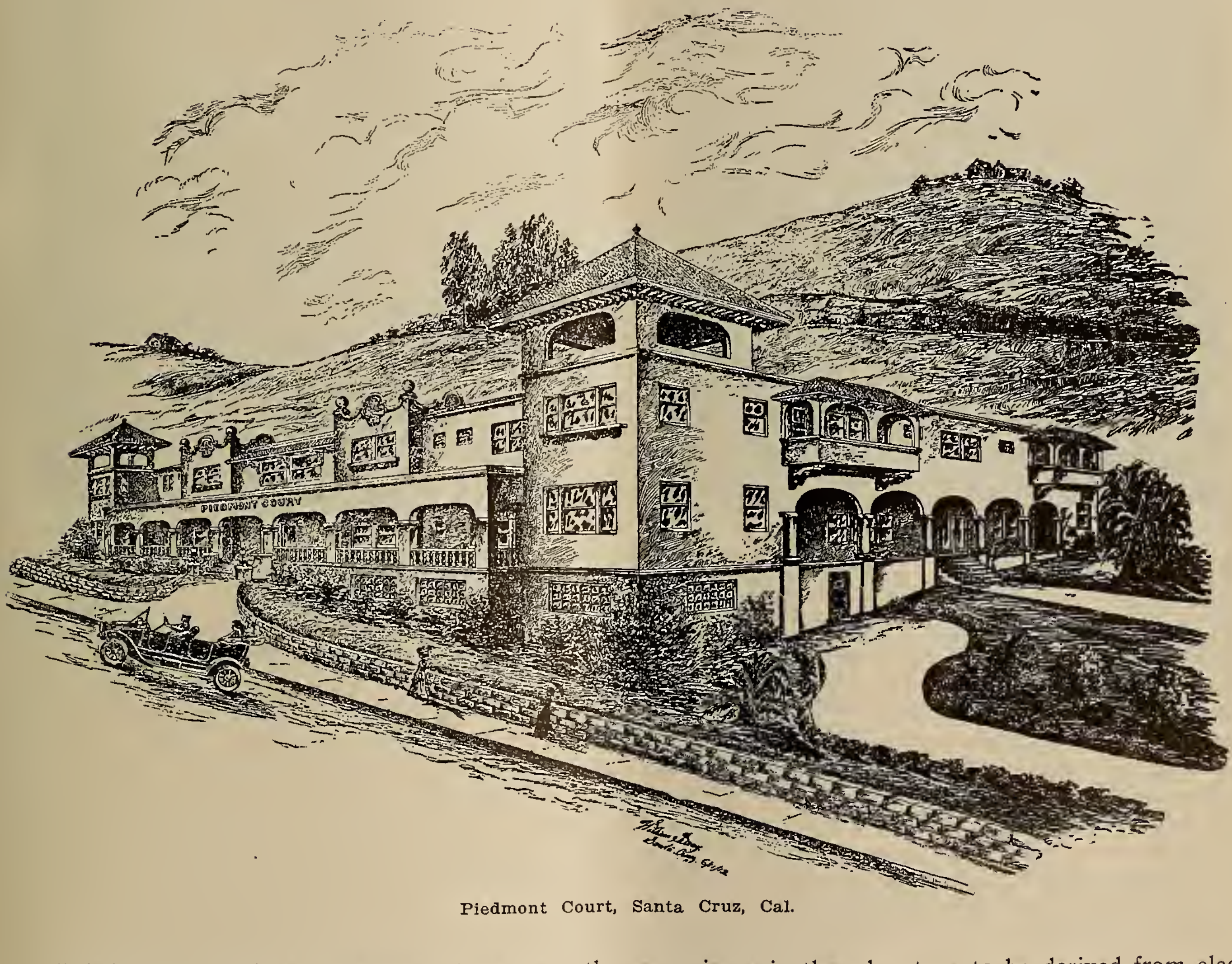
AN ELECTRIFIED APARTMENT HOUSE

BY GEO. R. PIMLOTT.



Piedmont Court, Santa Cruz, Cal.

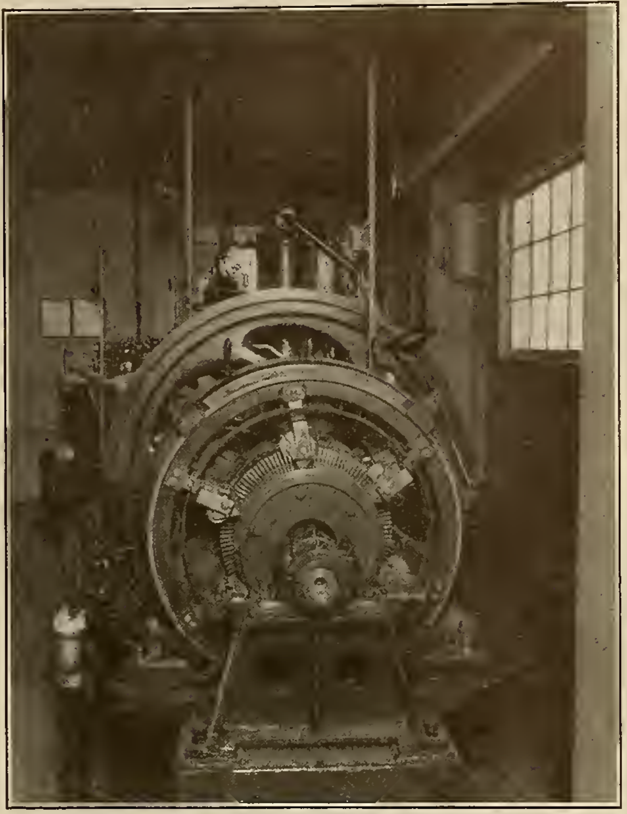
"Piedmont Court" is an apartment house recently constructed at Santa Cruz, California, which is remarkable for the complete manner in which it has been electrically equipped. It is believed that in no similar building have such elaborate preparations been made to do everything electrically and as such it should interest the readers of this journal. The owner, Mr. Pedro B. Chisem, gave the electric engineer free rein in planning electrical conveniences because of his wide experience in the advantage to be derived from electrical operation.

The building is of re-inforced concrete, in a beautiful combination of the Moorish and Mission styles of architecture, and situated so as to command an extensive view of the city of Santa Cruz and Monterey Bay. It is two stories in height and covers a ground area of 125 by 140 ft., and surrounds a glazed court 50 by 65 ft. It contains twenty-four apartments of two, three,

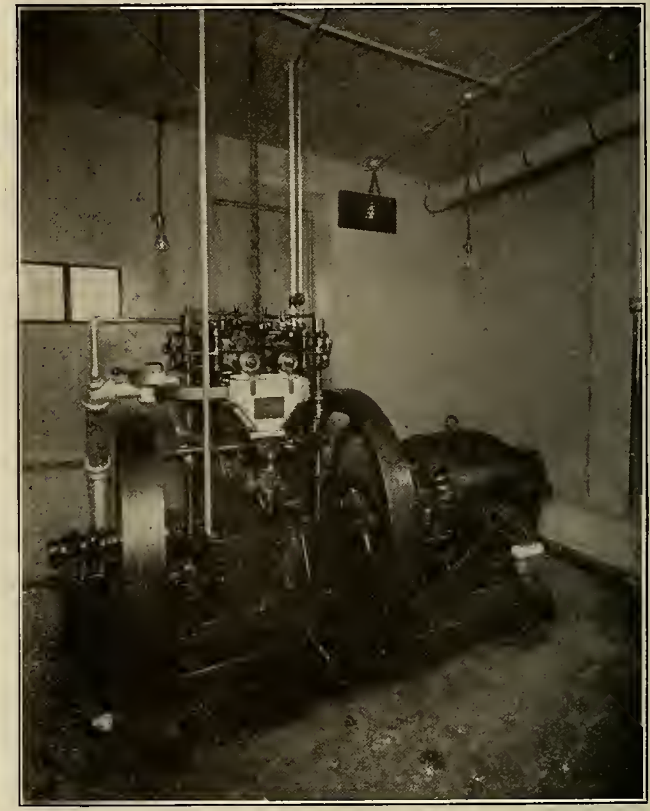
four or five rooms, a barber shop and a cafe. A spacious roof garden covers the entire roof area. The floors and roof are of re-inforced concrete throughout.

Power Equipment.

The power equipment consists of two units, one 35 kw., d.c. 115 volt, Ideal generator, 3 per cent over-compounded, direct connected to a 61 h.p. three cylinder Union engine, running at 325 r.p.m. and one 10 kw. d.c. 115 volt Ideal generator, 3 per cent over-compounded, direct connected to a 16 h.p. two cylinder Union engine, running at 425 r.p.m. Both engines start on gasoline and run on a low distillate, operating in multiple when the plant is operated at full load. The engines are regulated for a speed variation not to exceed three per cent, zero to full load, and this change occurs so quickly between these extremes that the fluctuation is hardly noticeable. The ignition of the engines is by the usual method, starting on battery and running on magneto, with the exception that any shut-down by a possible accident to either magneto has been forestalled by installing a switch to permit both engines to run on either magneto and throw-over switch on the battery circuit to enable the attendant to start either engine on either battery. The objectionable features of the exhaust are done away with by running separate exhaust pipes to a concrete pit 4 ft.x 4 ft. x 2 ft., placed 2 ft. underground at a distance of 40 ft. from the engines and covered by an 18 in. manhole cover to act as a relief valve should gas accumulate in the pit, and be fired by the exhaust. The burnt gases are cooled by discharging the water from the jacket of the engine into the exhaust pipe 2 ft. below the exhaust valves. The final result is an entire absence of smoke, smell and noise usually accompanying the operation of engines of this type.



35 kw. Generating Unit.



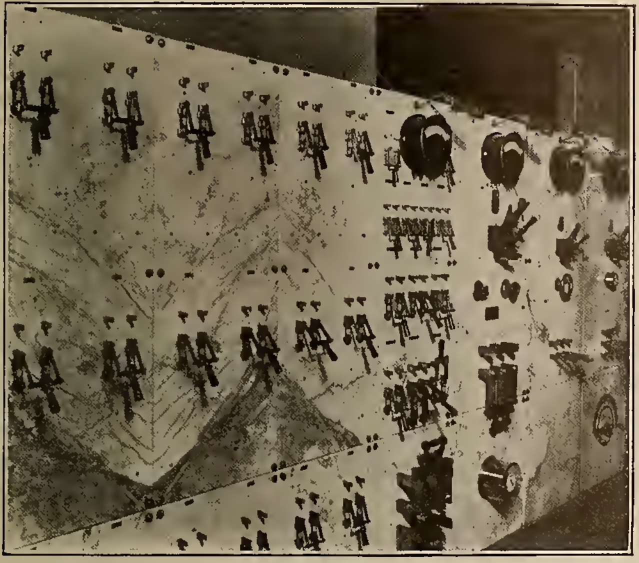
10 kw. Generating Unit.

Switchboard.

The switchboard is of white Alaska marble, 7 ft. high by 15½ ft. long. It is of panel type construction. Four sections 20 in. wide and 7 ft. high contain the switches for the apartments and spaces for the meters. One motor panel 22 in. wide and 7 ft. high carries the voltmeter, motor switches and the main switches for the public lighting. At the bottom of this panel has been installed a 400 amp. triple-pole, double-throw switch for cutting over the lighting to an outside source in case of emergency, leaving the motors, which are all of direct current type, to operate on the storage battery or either generator. One section 28 in.x 7 ft. for each generator, on one of which is mounted a 600 amp. Sangamo shunt type watthour meter which registers the entire generator output of the plant. The storage battery panel is unique in its absence of complicated switches to confuse the operator. The overload circui-breaker is equipped with an underload device, to protect the battery should the charging current fail, and a shunt release to open the breaker on full charge and discharge of the battery. This shunt release is also used in conjunction with the reverse current relay to protect the charging generator. I found it necessary to add to the equipment of this circuit breaker an auxiliary contact to open the circuit through the shunt trip coil to prevent any possible blistering of the contacts in the reverse current relay and ampere hour meter; also a device to prevent the dropping of the underload trip when the load fell below a predetermined value on discharge.

The ampere hour meter is of the Sangamo distant dial type with contact at zero and resetting device, and is compensated for overcharge and rapid discharge, and has totalizing circle for correct reading on discharge.

To charge the battery, which consists of 68 cells of Gould lead battery (Plante type) of 120 amp. hour capacity, the operation is to throw in to the charging position the circuit breaker and the triple pole double throw knife switch, which is equipped with two auxiliary contacts for the meter. This action cuts the battery into two equal parts and throws both halves in multiple across the charging circuit and through the auxiliary contact speeds the meter up 15 per cent for overcharge. When the battery has cut out on full charge



Switchboard.

and the switch is thrown in discharge position, the two halves of the battery are thrown in series, the voltage is adjusted to the line by the usual method through a hand operated rheostat of ample capacity in series with the battery. This battery occupies a space 3 ft. by 22 ft. in a specially constructed battery room adjoining the engine room and every precaution is taken to prevent the battery fumes from penetrating to any part of the building.

Electric Equipment.

The rotary burners of the heating and hot water boilers are supplied with crude oil by electric driven pumps. The cleaning of the building is done by a stationary vacuum cleaner in the basement driven by a 1½ h.p. motor equipped with a self-starter, so that it can be operated direct from the engine room.

An electrically driven elevator for freight and passengers runs from the basement to all floors and the roof garden, and an electrically driven dumb waiter carries the food stuffs from the kitchen to the cafe.

The lighting of the court, a portion of which is shown with fountain in the foreground, is arranged to be controlled as a theater. Ample provision has been made for lights for musicians, spot light, receptacles set in the ceiling for festooning the court for special occasions and base plugs at the first floor level for individual tables or writing desks. The ventilating skylight of this court is raised and lowered by an electric motor by the simple pressing of a button, the motor and mechanism automatically taking care of the distance of travel, direction and stop.

Wiring.

The wiring of Piedmont Court is entirely in Electroduct conduit with the exception of the wireway in the basement. This wireway is 4 in. by 12 in. and is 400 ft. long, running the entire distance of the basement hallway and picking up the cables feeding the various apartments and panel boxes. It is constructed of 14 gauge black iron and has a removable cover screwed to a 4 in. channel of the same gauge metal, and is suspended from the ceiling by ½ in. crowfeet set 6 ft. apart and cast into the concrete. This method is cheaper than conduit in cost and installation and much more easily handled when it came to putting in the wire. The wireway is tapped at the switchboard by a section 6 ft. wide (shown in black above the generator panels) which allows the wires ample room when they come through for distribution to the various switches.

The apartments are well supplied with base plugs for various electrical devices. Brackets are located at each wall bed for reading and at each wash basin for shaving. All closets are supplied with 15 watt tungsten lamps, and perhaps the most novel departure in the way of convenience and assistance for the housewife is the provision of each apartment with Copeman automatic electric cooking stoves by which the family meals may be prepared with the minimum of attention.

The building is equipped with Pacific telephones for interior, local and long distance communication, contained in a single unit, one of which is located in each apartment and at various convenient points about the building and on the roof garden. There are no chimneys or ventilating flues from the apartments in this building, except the chimney from the boiler room. It was the original intention of the writer to circulate the water, which cools the engine cylinders, throughout the building by an electrically driven pump, thereby saving this waste heat and eliminating this chimney.

Electric Fountain.

In this court is an electric color-changing fountain, the reservoir of which is 8 ft. in diameter, surrounded by a circle of 60 tungsten lamps with reflectors set 6 degrees apart, around a ring under the reservoir and concealed from view from above. The upper portion of the reservoir is fitted with spun brass rings, soldered on the under side of it, and directly over the lamps. Over these are fitted round pieces of blue, red and yellow glass, the Moorish colors, 3 in. in diameter, and the whole made water tight by setting up in a compound of litharge and glycerine, and a second retaining ring covering the edge of the glass and tacked with solder to the upper part of the reservoir.

The nozzles, fitted to containers, through which the water comes, form four geysers, one 13 in. in diameter at the center of the reservoir and three 9 in. in diameter set around a circle 51 in. in diameter, 120 degrees apart. These containers are made of two

Court and Electric Fountain.

sections of spun brass of different diameters brazed together so as to form a series of jets around the periphery of the circle which unite to form the geyser. The nozzles are 1 in. long to permit of adjustment and have an inside diameter of .0312 in. and are set .3 in. apart. This container sets over a thimble soldered to the bottom of the reservoir and raises to a height of 4 in.; over it is placed a circular piece of plate glass set in a litharge-glycerine compound and held in place by a retaining ring. By this arrangement I succeeded in raising a comparatively small amount of water to a greater height than could otherwise be obtained without an expensive pumping plant, and at the same time broke the water up into a fine spray or mist which I found could be colored to a greater height and at less expense than by using a greater volume of water without this arrangement.

Fountain Mechanism.

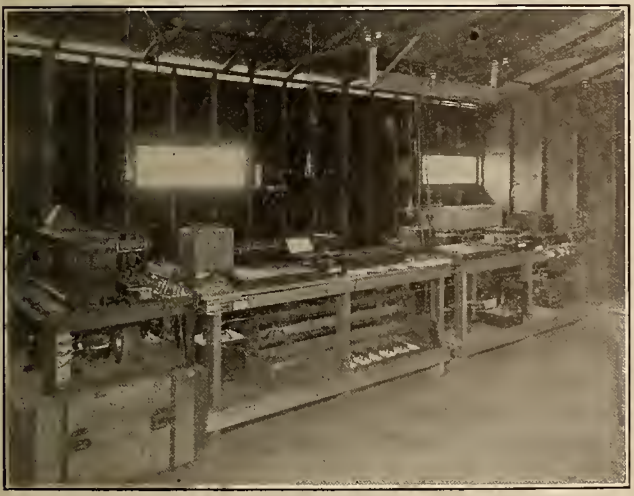
The color changes are made in a simple way and are continuous and constantly varying. A combination of red, blue, yellow and clear glass discs, cut in four equal sections to form a circle and the whole held together under a clamping device at the center and kept secure by a binding of lead such as is used in art glass manufacture, is rotated by an electric motor at a speed of three revolutions per minute between powerful tungsten lights set in reflectors directly below the clear circular glass discs. The result is pleasing and no great expense is attached to operating the fountain as it consumes only 130 cu. ft. of water and 3000 watts per hour. The colors are constantly blending and many different tints are thrown upon the spray, leaving a pleasing impression of its performance. There is no evidence of the mechanical regularity so tiresome in fountains of this type.

GENERAL PROGRESS REPORT OF COMMITTEE ON INDUCTIVE INTERFERENCE.

The Committee of Engineers representing the electric wire interests in the State of California, authorized by the California State Railroad Commission in December, 1912, to investigate the subject of inductive interference between power and communication lines and to make recommendations for commission rulings intended to prevent undue interference, reports progress up to September 1, 1913, as follows:

Since the first of the year a field force of from five to eight experimenters and computers has been engaged in collecting and computing data under instructions from the committee. The field force is equipped with a large amount of apparatus, including an oscillograph having three vibrators, noise standards, an impedance bridge, complete equipment for harmonic analyses and instruments of various kinds, the total aggregating in value approximately $9,000. Some of this equipment has been necessarily designed especially for this work.

Equipment is provided for harmonic analyses by either or both of two methods. The first involves the use of the oscillograph, the recorded waves of which are greatly improved for harmonic analysis by the use



Interior View of Laboratory, Showing Testing Apparatus.

of a distortion circuit. This consists of a circuit containing inductance and capacity so chosen as to give distortion of the harmonics in approximate proportion to the square of the order of the harmonic. The second method of harmonic analysis is by means of the use of what is termed the resonant shunt. This consists of a circuit containing inductance and capacity so chosen that in combination with the capacity of the telephone line the whole circuit can be made to resonate for any particular frequency or harmonic, the magnitude of which it is desired to measure. The currents so obtained are too small for direct measurement by any instruments available or suitable for this purpose. For this reason each current so obtained is passed through a telephone receiver, and the amount of noise given by same is equated with the noise in the same receiver produced by a current of the same frequency and of sinusoidal wave shape produced by a wave generator consisting of a Vreeland oscillator. The latter current is computed from the constants of a circuit supplied by a measured potential difference.

The noise standard above mentioned is an instrument designed to measure the volume of noise that is produced by the current induced in the telephone line. This is accomplished by equating the noise set up by this complex wave in a telephone receiver with the noise set up by a pure sine wave of known amplitude having a frequency of 240 cycles. This comparison, of course, involves, in a large measure a personal element, but this is reduced in these tests by taking as a rule the average results of four observers trained to the work by experience.

The parallels on which this work has now been completed are four in number, all of which involve one telephone line. This is the main coast line trunk lead of the Pacific Telephone and Telegraph Company (the Bell System on the Pacific Coast), between San Francisco and Los Angeles. These parallels are all located in the Counties of Santa Clara and Monterey, between San Jose and King City, a distance of approximately 120 miles. The telephone lead consists in the main of ten copper physical circuits, part of which are loaded and some of which are made up into phantoms. The high tension portions of these exposures are as follows:

First—A 57,000-volt 3-phase line of the Sierra and San Francisco Power Company, approximately 20 miles long, between San Jose and Gilroy.

Second—A portion of the same line, approximately eight miles long, running into Salinas.

Third—A 22,000-volt 3-phase line of the Coast Counties Gas and Electric Company, approximately 16 miles long, between Morganhill and Sargents, and overlapping the above-mentioned line of the Sierra and San Francisco Power Company from Morganhill to Gilroy, for a distance of approximately 10 miles.

Fourth—A 33,000-volt 3-phase line of the Coast Valleys Gas and Electric Company. approximately 40 miles long, between Salinas and King City.

All of the above power lines are operated at 60 cycles.

In all cases the telephone pole line is on one side of a public highway, and the power line or lines on the other side, with an average separation of approximately 60 ft. The power lines of the two separate companies overlapping as mentioned above, are erected one above the other. As these two power systems are operated from separate sources not in synchronism with each other, and as neither one can be shut down to enable the influence of the other to be independently measured, the difficulties of analyzing the inductive effects in this exposure have been enormously increased.

In order to eliminate the effects of induction from other power systems on through telephone circuits and from them to lines under test in the various exposures, it is necessary to cut all telephone circuits on the lead at the two ends of the exposure under test. Since the telephone lead is a main line of vital importance to the system of the telephone company, it has been necessary to make practically all tests between the hours of 10 p. m. and 6 a. m.

Since the line of the Sierra and San Francisco Power Company between San Jose and Salinas is the only source of electric power for the greater part of Monterey County, it has been impractical to suspend

service on this line for obviously desirable special tests, such as single phase short circuit runs with ground return, the application of single phase potential to ground on open circuit, etc., except on the rare occasions of general changes made by the power company, thus increasing the difficulties of the investigation.

The system of the Sierra and San Francisco Power Company is operated with a solidly grounded neutral, and facilities were available for readily grounding the neutral of star connected transformers in the substation at Salinas, or removing the ground connection. This has enabled a thorough comparison to be made of the inductive effects of this system; first, with a neutral ground beyond one end of the exposure; second, with a neutral ground beyond each end of the exposure, the latter condition giving a return path through ground for unbalanced currents in the line conductors. The system of the Coast Counties Gas and Electric Company is operated without a grounded neutral, making it possible to obtain a certain amount of comparative data between grounded and ungrounded systems, the comparison being limited by the facts that the two systems are of different voltage with different lengths of exposure largely overlapping, different sizes of conductors, different spacing of power wires, etc.

Thorough investigations have been made of residual and balanced currents and voltages in the power systems, of the shielding effects of other wires on the telephone lead, of the existing transposition systems in both the power and telephone lines, and of the relative locations of the power and telephone transpositions; also of the effects of modifications of these transposition schemes.

Throughout parts of the above exposures of the telephone line, the same power lines parallel the Western Union telegraph wires and the signal circuits of the Southern Pacific Company on the railroad right of way of the latter company. The effects of the power lines on these circuits have been included in the investigation.

The analyses of the inductive effects have been laborious on account of the large number of different forms of induction in action simultaneously. These may be listed as follows:

First segregation—Electrostatic and electromagnetic.

Second segregation—Effects of balanced and of residual currents or voltages.

Third segregation—Longitudinal and transverse induction.

The terms used by this committee under the above third segregation may be defined as follows:

Longitudinal induction is that which sets up an e.m.f between a wire and ground, or a current through a wire with a ground return, or a current induction is that which sets up an e.m.f. between two wires, or a current in a circuit made up of two wires without a ground connection. It is obvious that in the case of a phantom circuit the transverse induction is that between the two sides of the phantom, each consisting of two wires. It is also obvious that in general the transverse effect is the difference between the longitudinal effects on the two sides of the circuit. It is also obvious that the transverse induction is that of chief interest from the standpoint of interference with telephonic transmission.

Referring to the above segregation, attention may be called to the fact that each form of induction, transverse and longitudinal, is due in part to electrostatic and in part to electromagnetic influence, and that only one of these four effects transverse electrostatic, transverse electromagnetic, longitudinal electrostatic and longitudinal electromagnetic, is due in part to the balanced currents or voltages and in part to residual currents or voltages. In order to make a complete study of the effect of transpositions, each of the eight effects must be considered independently. The transposition problem is further involved by the necessary transposition system of the telephone wires between themselves to avoid crosstalk, which in itself is elaborate on a heavy lead.

In the case of the exposures so far investigated, it has been impossible to get enough transverse induction under normal operating conditions to obtain oscillograph records of sufficient amplitude for harmonic analysis. The study of the transverse induction has therefore been limited to the results obtained from the noise standard and the use of the resonant shunt apparatus. A difficulty introduced by this condition is that the use of the resonant shunt apparatus involves successive measurements of the several harmonics. Between the times of these measurements the load on the power system may and does vary, and what is more essential, the shape of the waves of the power system, and particularly of the residuals and of the neutral current of same varies.

On the whole, the investigation, so far as the currents and voltages of the power system are concerned, has resolved itself into a determination of the relatively small difference between almost exactly equal quantities, that is, into a determination of the residual voltages and currents which are minute, compared with the main voltages and currents. This has involved an elaborate study of the errors introduced by the use of the necessary current and potential transformers, and particularly of the effects of same on the higher harmonics. As might be expected, the work of computation and the analyses of the data obtained greatly exceed the work of actually making the tests.

The joint committee has a membership of fifteen engineers, part of whom represent the power interests, part of communication interests in the State of California and part the State Railroad Commission. The necessary funds for the work have been voluntarily contributed by the power and communication interests of the state. A large amount of the apparatus used has been loaned by the Pacific Telephone and Telegraph Company, some has been purchased by the committee, and a relatively small amount, consisting of current and potential transformers, oil switches, etc., has been loaned by the power companies.

So fas as can be determined by the members of the committee, no investigation of these complicated phenomena has ever been undertaken heretofore on a scale comparable with that of this work, either in magnitude or in the matter of thoroughness. The study has developed into an investigation of much

greater scope and complications than was originally anticipated. Although eight months have already been spent on this work, which has not been allowed to drag, but has been pushed continuously and as rapidly as possible without detriment to the work, the investigation has not as yet been made on a sufficiently large number of exposures of different characteristics to allow of any general conclusions. No statement can as yet be made regarding the recommendations of this committee on this set of exposures, since these recommendations have not as yet been presented to the State Railroad Commission. While the complications of the problem now appear to those carrying on the work so great as to make extremely difficult the drafting of general remedial measures which shall not be onerous on the interests involved and shall not be subject to so many exceptions and alternatives as to make them ineffective, the committee expects that with sufficient time and financial assistance this work can be made to serve as a basis of rulings which will be not only helpful to the communication interests, but also to the power interests in the way of standardization of construction and operating methods and the reduction of interruptions to service. Members of the committee also feel that, more important than the above, the work will enable the Railroad Commission to make rulings which will in future reduce harmful agitation, legislation and litigation.

GAS SERVICE PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

Steam service will be available in the Palace of Machinery during the day hours only. Saturated steam, at a pressure of 150 pounds will be furnished through a system of mains from the Fuels Building immediately in rear of the Palace of Machinery, and from the central station. In like manner, 1000 to 1500 boiler horsepower of steam will be supplied. In the Fuels Building will be established at such exhibits as steam and gas producers. These will be working exhibits and subject to exposition awards. Steam generated in this exhibit plant will be disposed of for satisfying the steam requirements of other exhibitors.

A limited supply of compressed air at 80 pounds pressure will be available in the Palaces of Machinery, Mines and Metallurgy and Transportation. The exposition will install a distributing system to these palaces, based on the use of standard screw pipe of sufficient size to handle the quantity requirement. The present plans contemplate the installation of an equipment sufficiently large to deliver 1500 cubic feet of free air per minute. This may or may not be acquired on exhibit basis.

Dull months are a "habit" and a "state of mind" more than anything else. They do not belong in the scheme of modern business economics. There is always a way to get more business. There is always a way to stimulate sales. There is always a way to bring the buyers to your store or the orders to your desk. If you'll tell the public what you have, tell it to them in the right way, and keep at it, you can make the dullest month in the year produce good business.

ELECTRICITY IN THE LUMBER INDUSTRY.

BY ALLEN E. RANSOM.[1]

The use of electricity in the manufacture of lumber has developed, within the last decade, to a point where it demands the attention of lumber manufacturers as a means of reducing the cost of production and effecting a definite conservation of material in its transit from standing timber to the finished lumber.

The object of this paper is to try and set forth just what can be and has been done in this important field, and the possibilities it offers to the field of applied electricity.

The data available is becoming more specific and reliable each succeeding year, and in our Northwest country the various associations interested have had this subject presented in various forms for several years. The proceedings of the "Pacific Logging Congress," an organization composed of the various logging and lumbering interests of the Pacific Coast, has given this subject considerable study and discussion; and with the increasing mileage of transmission lines and power plants in our timbered sections, this outlet for power is ultimately going to develop into commercial recognition and profit to both the user and the transmission company.

The reasons for the use of electricity are so well known that we will not take up space in setting these forth, but proceed to facts and figures of existing mills.

Mill A

Location—Northwestern Montana.

Source of Power Supply—Own plant. Auxiliary from Power Transmission Company 750 k.v.a. 440 volt. 3600 r.p.m., 3-phase, 60 cycle, steam turbines, 150 lb. pressure, condensing. The only steam used in this mill is for operation of carriages, log turners and kickers; in its mechanical operations and in the dry kilns and log ponds for thawing and clearing logs of ice in winter.

Daily Capacity—800,000 ft. per day.

Fuel—Mill refuse.

Kind of Timber—Yellow pine, larch and tamarack mostly.

Motor Applications—All motors 3-phase, 60-cycle, 440 volts.

Pump House—100 h.p.; wound rotor; 495 r.p.m.; geared to 10x12 in. 1000 G. P. M. fire pump and controlled by automatic pump starter on motor. 5 h.p. motor on 4x4 in. triplex pump; 3 h.p. geared to 5x5 in. plunger pump; 3 h.p. geared to small air compressor. Auxiliary to above pump house station is a transformer house, in which are installed: Three transformers of sufficient capacity to operate 100 h.p. fire pump motor from Power Transmission Company. System which transmits power at 11,000 volts adjacent to the mill company's property also. Three 250 kw. transformers, with connections on the 11,000 volt primary side to the Power Company Transmission System; and on the 440 volt secondary side to the entire mill power wires.

Boiler House:

One 15 h.p. motor, and one 20 h.p. motor run cross conveyors for stokers and sawdust conveyors to fuel bins.

[1]Paper presented before the N. W. Electric Light and Power Association Convention, Seattle, September 3-5, 1913.

Mill.

Two 8-in. hand mills, each operated by 150 h.p. wound rotor, 580 r.p.m., belt connected motor with idler pulley.

Log Haul—Operated by a 50 h.p. 850 r.p.m. motor. Squirrel cage type. The auto starter for this motor is located at head of log haul.

Band Saw—Operated by 50 h.p. squirrel cage motor.

Edger—75 h.p. 1700 r.p.m. squirrel cage motor connected to a 96x8 in. edger, with 4 saws each end.

Pony Edger—30 h.p. squirrel cage motor. Twelve saw trimmer. Operated by 30 h.p., 565 r.p.m. squirrel cage motor, coupled to trimmer jack shaft.

Saw Slasher—Direct coupled to 30 h.p. 850 r.p.m. squirrel cage motor. Timber cut off saw operated by 5 h.p. squirrel cage motor. Sorting works operated by 30 h.p. motor; 380 ft. long. Also lumber loader operated by same motor.

1—30 h.p. motor—Running Lath Mill.
1—50 h.p. motor—Running Bolter.
1—10 h.p. motor—Running Cut-off Saws.
1—10 h.p. motor—Running Stove Wood Slasher.
1— 5 h.p. motor—Running Filing Room.
1—20 h.p. motor—Running Log Transfer.
1—20 h.p. motor—Running 260 - ft. of Timber Transfer Chains.
1— 5 h.p. motor—Running Slab Conveyor.
1—75 h.p. motor—Running Chain to Burner and Slab Chains in Lath Room.
1—30 h.p. motor—Running Sawdust Conveyor length of Mill.
1—10 h.p. motor—Driving Live Rolls and Transfer Chains to resaw.
1—15 h.p. motor—Driving Live Rolls to Transfer Chains.
1—20 h.p. motor—Driving Transfer Chains from Edgers to resaw.
1—30 h.p. motor—Driving Transfer Chains to Slasher and Live Rolls from Lumber Transfer and Band Mills.
1—15 h.p. motor—Driving Timber Transfer and Lumber Transfer Laths.
Total—30 motors.
H.P. installed—1191.

This mill is a typical example of an electric driven mill and also illustrates the feasibility of an outside source of power from a nearby transmission system:

With comparatively small variation of equipment and application of the motor drive, which differs according to the kind and size of timber, there are now operating commercially over 50 mills in Montana, Washington, British Columbia, Idaho and Oregon, using electric power wholly or in part, in the manufacture of lumber by means of electric logging donkeys, main mill drives as just shown, planing mills, box and tank factories, etc., auxiliary to the main mills.

The load factor of a mill, equipped electrically as above, is about 50 per cent; planing mills 60 per cent; logging donkeys 40 per cent of the h.p. installed.

The following report of an electrically driven planing mill purchasing power from a transmission company will prove of interest:

MILL B—Northwestern Washington:
Power supplied—220 volts, 3 phase, 60 cycle.
Connected Load—315 h.p.
All Planers, Stickers and Blowers direct connected to motors.
Location—Northwestern Washington.
Date—March 31, 1912—December 31, 1912.
Feet of Lumber Manufactured—3,677,447 ft.
Lin. ft. of Mouldings in B. Measure—170,200 ft.
Total—3,847,650 ft.
Power Consumed—160,886 kw.-hr.
Average per month—17,876 kw.-hr.
Average per M. ft.—41.8 kw.-hr.
Average cost per M. ft.—$0.41.
Rate—$0.01 per kw.-hr.
Minimum—$1.00 per h.p. per month, Max. demand.

The following wattmeter tests were made right at the machines in commercial operation and illustrate the average daily operations of planing mill machines, their output and power consumed and which are average examples of similar conditions in mills using Washington and Oregon fir.

Wattmeter, Start.	Stop.	K.W.	Bd. ft. per K.W.	Time. Start. St'p.	Load No.	Dimensions. Rough.	Finished.	Lin. ft. and Board.	Rate of Feet.
588	605	17	115	7.05- 7.40	1	2x6″	1 5/8x5 1/4″	1950	60′
2	"	"	571	"	605	613	8	71	7.46- 8.03
3	"	"	1866	"	613	630	17	109	8.07- 8.42
4	"	"	1522	"	630	645	15	104	8.48- 9.16
Change Material—Green Hemlock. Finished—One side surfaced.									
5	1x12″	3/4x12″	1481	68′	654	652	7	211	9.24- 9.52
6	"	"	1289	"	652	657	5	255	9.55-10.14
7	"	"	1406	"	657	662	5	281	10.16-10.37
8	"	"	1280	"	662	668	6	213	10.44-11.03
9	"	"	1378	"	668	673	5	278	11.08-11.28
10	"	"	1438	"	673	679	6	240	11.30-11.53
Noon Hour.								Empty	11.56-12.00
11	1x8″	¾x8″	1802	68′	679	685	6	200	12.50- 1.11
12	"	"	2147	"	685	693	8	179	1.14- 1.45
13	"	"	21.40	90′	698	699	6	238	1.49- 2.12
									2.19- 2.34
14	1x12″	3¾x12″	1117	90′	699	704	5	223	2.36- 2.38
Change Material—Green Fir. Finished—Silo Tank Stock. Both sides Matched.									
15	2x6″	1⅝x5¼″	1074	60′	704	714	10	174	3.11- 3.32
16	"	"	1768	"	714	729	15	118	3.34- 4.04
17	"	"	902	"	729	736	7	129	4.12- 4.28
18	"	"	2073	"	736	757	21	99	4.31- 5.09
19	"	"	1455	"	757	768	11	132	5.17- 5.43

Total days run, 472 minutes = 7.8 hours. Kw.-hr. consumed = 180.
Planed, total lumber = 28659 ft. Bd. ft. per kw. = 159.

TEST No. 1:

Motor—50 h.p., 2-phase, 60 cycle, 440 volt, 53 amps., 850 r.p.m.
Machine—No. 20, 15-in., S. A. Woods Matcher.
Material—Kiln Dried Fir. Pipe Staves, Surfaced 2 sides. Bev. Edges.

Load.	Dimensions. Rgh.	Fin.	Lin. ft.	Bd. ft.	Rate of Feed per min.	Wattmeter Start.	Stop.	K.W.H.	Bd. ft. per K.W.H.	Time Str. St'p.
1	2x6″	1 3/4x 5 9/16″	0	0	72′	4526				7.02- 7.20
1	"	"	1420	1420	"		4541	15	95	7.25- 7.28
2	"	"	1540	1540	"	4541	4554	13	118	7.28- 7.52
3	"	"	1048	1048	"	4554	4570	16	66	7.52- 8.25
4	"	"	920	920	"	4580	4580	10	92	8.25- 8.48
5	"	"	628	628	"	4580	4587	7	89	8.48- 9.05
6	"	"	1056	1056	"	4587	4596	9	117	9.05- 9.24
7	"	"	1230	1230	"	4596	4609	13	95	9.24- 9.52
8	"	"	1710	1710	"	4609	4626	17	100	9.52-11.03
9	"	"	1840	1840	"	4626	4645	19	97	11.03-11.47
10	"	"	1502	1502	"	4645	4660	15	100	11.48- 1.11
11	"	"	1384	1384	"	4660	4671	11	126	1.11- 1.33
12	"	"	934	934	"	4671	4680	9	104	1.33- 1.53

Total Run—5 hours 45 min.
No. ft.—15,212.
Kw.-hr. used—154.
Bd. ft. per kw.—99.

TEST No. 2:

Motor—100 h.p., 440 volts, 60 cycle, 2-phase, 680 r.p.m.
Machine—70-inch Double Sturtevant Fan.
Main Discharge, 32-in. diameter. 500 ft. long.
Intake Pipes, 3-9-in. Pipes.
3-8-in. "
10-7-in. "
17-6-in. "
6-5-in. "

Plaining Machines connected to Fan:
1 resaw.
1 Sticker.
7 Planers.
1 Timber Planer.

Average Days Run:
Start 6:52 a. m. Stop 6:00 p. m.
Total minutes run during day, 623 = 10.4 hours.
Wattmeter reading at 6 p. m., 3764 kw.-hr.
Wattmeter reading at 6.52 a. m., 2976 wk.-hr.
Kw.-hr. during day, 788.
Average load on Fan = 78.8 kw.

TEST No. 3:

Motor—60 h.p., 440 volt, 60 cycle, 3-phase, 850 r.p.m.
Machine—Slow speed, high power, Sturtevant, double 55 Fan. Main discharge pipe, 30-in. in diameter; 700 ft. long.
Intake Pipes, 2-8-in. Pipes.
2-7-in. "
10-6-in. "
3-5-in. "
5-4-in. "
1 extra vent about 35 sq. in.

Fan connected to:
1 Flooring and siding machine.
1 Planer.
1 Sticker.
4 14-in. Swing Cut Off Saws.
1 12-in. Rip Saw.
1 Resaw.

Motor started 7:30 a. m. Stopped 6 p. m.
Days run, 6½ hours.
KW. Consumed, 281.
Average Load on Fan, 31 kw.

TEST No. 4:

Motor: 50 h.p., 440 v., 3-phase, 60 cycle, 850 r.p.m.
Machine: Berlin No. 94 Planer:
Top—Cutter head. Square—4 knives.
Bottom—Cutter Head. Square—4 knives.
Side—Cutter Head. Matcher—4 knives.
Material: Green Fir. Finished—Silo Tank Stock. Both sides matched.

The foregoing tables and descriptions are made from operating mills, and in connection therewith a number of interesting installations of motor driven donkeys for use in the woods are in service at Elk River, Idaho, and Marshfield, Oregon, the power from same being transmitted from the mill power station or supplied by transmission lines; stepping down to the operating voltage of 440 volts, 3-phase, 60 cycle, and carried from the step down station to the donkey by means of 3-wire flexible wire wound cable. Motors of the wound rotor type; speeds about 600; horse-power 150-165, are direct connected to standard logging engines and by means af automatic circuit breakers; drum type reversing controller, and air whistle signals; the handling of the logs in the woods by electricity has demonstrated its advantages in reduced labor cost, less fuel consumption; elimination of fire risk and flexibility of service.

The increasing number of transmission lines in the Pacific Northwest through timbered sections through districts where operating mills and logging camps are running makes probable and possible the installation of substations and the sale of electric power.

The average donkey in the woods will handle from 30,000 to 40,000 ft. of logs per day. Several tests of electric donkeys in this service have indicated a load factor of from fifteen to forty per cent and a current consumption of from 15 to 20 kw.-hr. per 1000 ft. of logs handled. Assuming a rate of 1.5 cents per kw.-hr. and a minimum of 1.00 per month per h.p. maximum demand the logs can be handled at a cost of not to exceed 50 cents per 1000 ft., and make a saving to the lumbermen of nearly one-half over the present methods of steam haul, in saving of labor, reduction of fire risk, labor and expense of getting water to the donkey, elimination of boiler explosions and repairs, and conservation of his supply of logs.

The cost of the electric donkey itself together with the necessary cable, portable substation and temporary transmission line to the point of operation does not make a prohibitive investment to the lumberman.

Some of these facts, therefore, give us an idea of the possibilities of electric application in this great industry.

Recent statistics show that the lumber industries of the country today employ about 700,000 men. The products of their labor reach nearly one and one-fourth billion dollars annually and three-fourths of a billion more by manufacturing this material into other commodities.

There are nearly two hundred million acres of forest land in the United States in American possession and conservation, economy of production, and efficiency has called electricity as the factor to gain these ends.

GAS SERVICES PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

There is to be a high pressure distributing system of gas mains throughout the grounds of the Panama-Pacific International Exposition at San Francisco in 1915, and gas will be furnished in all exposition palaces. Oil gas, as made and used in California from crude California petroleum and having a heat value of 600 B.t.u. per cubic foot or more, with a candle power in excess of 18, will be served to participants at a pressure of 30 pounds. This gas is exceptionally free from sulphur and other impurities. The pressure may be reduced to anything less than 30 pounds, and suitable for the use to which the gas is to be put, by means of regulators. The low pressure in buildings will be about 6 in. of water pressure.

Gas will be used for many lighting and heating purposes, and no other source of heat will be allowed, except electricity, unless special permission has been granted otherwise. The rules and regulations of the exposition company are very strict on this point, with a view to reducing the fire hazard to a minimum.

All of the ground lighting for emergency purposes will be by means of gas arcs. This provides essential secondary lighting system throughout the main exhibit palace district and about such other exposition buildings and entrances as public safety may require. In the states and foreign section and in the concessions district, the street lighting will be by means of gas arcs. The rules and regulations provide that all light furnished by others than the exposition company, whether for decorative or other purposes, shall be of uniform brilliancy and all light sources of great intrinsic brilliancy shall be fitted with suitable globes or diffusers, so as not to cause a disagreeable effect upon the eye.

ELECTRICAL PUMPING AND IRRIGATION

THE SELECTION AND INSTALLATION OF A SMALL PUMPING PLANT.

(Continued).

BY B. A. ETCHEVERRY.

The capacity of the pump will depend on the diameter of the cylinder, the length of the stroke of the piston, and the number of strokes or revolutions per minute. The capacities of a few sizes of double acting, single piston pumps, single acting triplex pumps and of double acting duplex pumps are as follows:

Capacity of double acting, single piston pump.

Diameter of water cylinder.	Length of stroke.	Revolutions or strokes per minute.	U. S. gallons per minute.
3"	5	40	12.4
4	5	40	21.6
5	5	40	34.
6	6	40	58.
7	6	40	80.
8	6	40	104.

Capacity of single acting, triplex piston pump.

3	4	50	18
4	4	50	32
4	6	50	50
5	6	50	76
5	8	45	91
6	8	45	131
7	8	45	180
7	10	42	210
8	10	40	270
8	12	40	310
9	10	40	340

Capacity of double acting, duplex pumps.

Diameter of water cylinder.	Length of stroke.	Revolutions or strokes per minute.	U. S. gallons per minute.
2¼	4	75	20
3	4	75	36
3½	6	60	58
4	6	60	78
5	6	60	120
6	6	60	174
5	10	50	170
6	10	50	245
7	10	50	334
8	12	50	522
9	12	50	660

The sizes of pumps and the capacities vary with the different manufacturers. The values stated above show the approximate range of the different sizes. For small capacities the double acting single piston pump may be used.

Deep well pumps are used where the water plane is at large depths below the ground surface. A deep well pump consists of a brass cylinder in which operate two plungers with valves. The lower plunger is connected to a solid rod which fits into a hollow rod to which the upper piston is connected. The plungers are so operated by the driving power that the pump is double acting, one plunger moving up while the other moves downwards, so that there is a continuous discharge. Above the cylinder and connected to it is the vertical discharge or column pipe into which discharges the water passing through the valves in the plunger. The cylinder is about 2 inches smaller in diameter than the well casing and the delivery pipe about 1 in. less; the cylinder and delivery pipe are both lowered into the well until the plungers are under water. At the surface the driving power and circular motion of the belt of the engine is transmitted to the driving rods by means of gears and levers combined into a lower head designed to produce overlapping strokes, so as to eliminate to some extent the pulsations, which are further decreased by an air chamber. The sizes range from 6 in. cylinders and 28 in. stroke to 16 in. cylinders and 36 in. stroke. The number of strokes ranges from 16 to 24 per minute, depending on the lift and the size. The maximum lift is 350 ft. The capacity ranges from about 115 gallons per minute to a maximum of 1000 gallons for the largest pump with extra long cylinder.

Air lift or compressed air pumping plants consist of one or more air lift pumps. The air compressor with receiver and motive power and the necessary piping to deliver the compressed air from the receiver to the pumps. Each pump consists of: (1) The discharge pipe, which is smaller than the well casing and is placed inside of it, extending below the water surface to a depth equal to 1½ or 2 times the lift measured from the water surface; (2) The air pipe, which is usually inside the discharge pipe, but may, if the well is enough larger than the discharge pipe to so permit, be placed outside and connected at the lower end of the discharge pipe by means of standard fittings or special castings; (3) The foot piece which is a special casting connected to the lower end of the air pipe and so designed to admit the air evenly in small bubbles. There are various designs of patented foot pieces, but there is little difference in their efficiency; (4) The tail piece which forms a slightly enlarged extension of the lower end of the discharge pipe below the foot piece. The air is delivered through the foot piece at pressures varying according to the lift and the ratio of diameters between air pipe and water pipe, and its expansion and displacement produces the lifting power. The relation between the volume of air supplied and the volume of water pumped for different lifts has been found by experiment to be as follows:

Head in feet........	10	20	30	50	100
Ratio—					
Cubic feet of air....	1.0	1.5	2.0	2.5	3.0
Cubic feet of water..	1.0	1.5	2.0	2.5	3.0

The velocity of water in the discharge pipe, based on the volume of water pumped should not exceed 5 ft. per second in order to keep down friction losses.

The compressor may be direct connected to a steam engine or gasoline engine or may be connected by means of belts, gears, etc., to the driving power which may be a steam engine, a gasoline engine or electric motor. The compressed air passes from the air cylinder to the receiver, which is used to store the air and equalize the pressure. From the receiver the air is conducted through pipes to each well.

The efficiency of the plant when properly installed as calculated from the ratio of actual water horsepower to the indicated horsepower in the cylinder of the engine is generally between 20 and 30 per cent. Air lifts are best adapted for pumping from several wells not farther apart than ½ mile and where the wells are sufficiently deep to allow proper submergence.

The hydraulic ram works on the principle that a large volume of water falling through a low head will pump a smaller volume of water through a higher head. The ram consists of the valve box and air vessel, the supply or drive pipe which connects the valve box with the source of supply and the delivery or discharge pipe which connects the air vessel with the point of delivery. The efficiency of the plant is $E = qh/QH$ where $q =$ volume of discharge water, $h =$ discharge head in ft. above ram, $Q =$ volume of drive water, $H =$ drive head in ft. For best results the ratio of the length of drive pipe to the length of drive head should not exceed 2.5; but it is practicable to increase this ratio to 25 and use a drive pipe 1000 ft. long. The delivery head may be anything up to about 250 ft. ond the drive head anything above 18 in. The efficiency diminishes as the ratio of delivery to drive head increases. With this ratio as great as 30 to 1 the efficiency will not be over 20 per cent; with a ratio not greater than 4 to 1 the efficiency may be as high as 75 per cent. Rankine gives the following equation to determine the efficiency for varying ratios of drive head to discharge head: $E = 1.12 - .2 \sqrt{\frac{h}{H}}$

Hydraulic rams are usually limited to small quantities of water. A notable example of a large plant for irrigation purposes is one installed at Sunnyside, Washington, for the irrigation of 240 acres of land. The plant was installed by the Columbia Steel Works of Portland, Oregon, and consists of eleven 6 in. rams, with a common discharge cylinder emptying into a 10 in. wood stave discharge pipe. The plant is used to irrigate 150 acres under 105 ft. lift and 90 acres under 144 ft. lift. The lifts are measured from rams. The drive head is 38 ft. and the drive water 5 second ft. the plant was furnished under guarantee to deliver .75 second ft. at higher outlet. The cost of plant is as follows:

11 6-in. rams and 3212 feet of wrought iron drive pipe.	$3,200
1900 feet of 10" wood discharge pipe	608
Installation complete	2,000
Total cost	$5,808

No maintenance except two visits per day to clear weeds out.

An efficiency test gave the following results: $H = 37.6$; $h = 144.1$; $Q = 6.25$; $q = 1.15$:

$$E = \frac{1.15 \times 144.1}{6.26 \times 37.6} = .70$$

[To be continued.]

TELEPHONE STANDING OF THE WEST.

It is intensely gratifying to note that Los Angeles and San Francisco are the two best developed telephone cities in the world; other western cities among the foremost being Spokane, Wash., and Portland, Oregon.

The latest available statistics show that San Francisco has one telephone to every four persons, as has Los Angeles also, the latter city having slightly the better showing in this regard. San Francisco is one of seven world cities having over 100,000 telephones in use, and Los Angeles ranks ninth in point of total phones installed.

STANDARDIZING MENTAL OPERATIONS.

A new thought has been developed by R. W. Babson in a recent issue of the Journal of the Efficiency Society which contains much to commend itself to executives. Any man knows from his own experience that a large part of his day's work consists in passing judgment on questions referred to him for decision.

All these things are "matters of judgment." In other words, each case is handled as an individual problem and decided on its own particular merits. "All things considered, it seems best under the circumstances"—is the usual basis of the verdict.

Mr. Babson questions whether a great deal of energy is wasted by not having policies more fully standardized and then sticking to these policies more religiously. Suppose that a manager has a definite one-price policy; his standard decision when shading was proposed would be "No." If his factory policy were to fill all orders in rotation by date of receipt, his position with respect to a rush order would also be "No." Those matters, therefore, would be cleaned up with practically no mental work at all.

The mental work would have been previously performed in planning the standard policies. This of course would have to be done with care and deliberation. When constructing a standard—in whatever line—neither time nor effort are spared to get the most perfect product possible.

The obvious objection to standardizing policies is that you may sometimes miss a profit or incur a loss. The author is inclined to believe, however, that in many cases we would be more scared than hurt. A prospective profit or loss always looks bigger than an invisible overhead expense. A hundred-dollar sale goes off like a bomb, but a hundred-dollar expenditure of a good man's energy is almost inaudible to the average ear.

This much is certain: There is a multitude of high-priced men whose chief activity is to answer over and over again practically the same questions. We would gain in the long run by answering these questions once for all, to the very best of our ability, and then take the losses if any, for the sake of the immense saving in nervous energy.

Do not overlook the opposite danger of getting in a rut or "rubber-stamp" management. An out-grown, ill-advised standard is worse than no standard at all. Moreover, all standards, particularly those of policy, must be continually studied and improved; it is this bigger job which should engage the best ability that money can command. His contention is that we can't afford to let such men wear themselves out deciding each particular case on its own petty merits. Let them keep in touch with detail, if necessary, but have this detail so standardized that it can be passed upon with the minimum of mental effort.

One secret of personally managing a large volume of work in a short time is to have at your command a set of standard decisions,—and the courage to apply them, and lack of courage is generally where the rub comes.

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E. B. STRONG,
President and General Manager.

Sworn to and subscribed before me thia 22nd day of September, 1913.
(Seal.) CHARLES EDELMAN,
Notary Public in and for tbe City and County of San Francisco, State of California.
(My commission expires April 9, 1914.)

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Inductive Interference

Of all the complex subjects with which the electrical engineer is confronted the inductive interference between wires used for communication and those used for power transmission is perhaps the most perplexing. Each year the meshes of the great network of wires with which the country is covered become smaller and the interference becomes greater, so that the demand for the elimination of this trouble is becoming more and more insistent. Added to the engineering complications which must be unravelled, are the legal tangles in which this skein of wires has become involved. The telephone company, as the party physically injured, brings suit against the power company, as the aggressor, and the lawyer usurps a function which rightfully belongs to the engineer, but which the latter has not yet been able to fulfill.

From the legal standpoint the defense usually lies with the power company, which is maintaining the nuisance. Though no binding decision has yet been made, the trend of previous judgments show that the line first rightfully in position is entitled to protection against interference by induction from the one subsequently in position. The injured company can usually get an injunction for its protection and the defendant has been adjudged liable for damages unless the wires were moved to obviate interference. On the other hand priority of occupation does not imply exclusiveness of privilege and the principle of the greatest good to the greatest number gives certain rights to the power company.

With regards to traction companies the situation is somewhat different as many states grant them superior rights because electric railway service is considered as an "ordinary use" of a street, whereas a telephone company is usually bound by its charter to yield subservience to a dominant use of the street. A majority of decisions has required telephone companies to devise some means of protecting their lines and so the problem again rests with the engineer.

This Gordian knot cannot be cut by the sword of justice. The mathematician and the scientist by patient investigation must continue in their search through the labyrinth until the secret is revealed and the engineer provided with the needed tools. This fact was recognized last year by the California Railroad Commission whose committee reports progress elsewhere in these columns. Most exhaustive tests are being made and valuable data is being accumulated which should form the basis for co-operation rather than competition between the conflicting interests.

Ignorance or Carelessness

When a street-car or railway accident occurs and lives are lost, condemnation leaps unguarded from a myriad lips. "Corporations are careless, or the motorman or engine-driver is to blame." And through ignorance on the part of those who condemn, such popular, though frequently erroneous verdicts, are allowed to pass unchallenged.

But be the condemned corporation ever so careful o life and vigilance of the driver or motorman unequalled, accidents may still occur. The contributing causes, some avoidable, are many, but are outside the jurisdiction of those upon whom the public, in ignorance of the real facts, endeavor to fix the blame. It is not unusual, when an engine driver has "ignored" and run past signals which were against him, and in the consequent wreck has passed out, for the same public to express their "sympathy" short enough and terse—"Served him right!"

None but the man killed would have been able to tell us why the accident occurred. It is well then that we give the "cause" a really sympathetic and intelligent consideration before we hastily condemn. A trespassing pedestrian walking along the tracks may have persisted in staying until the last moment before making for the devil-strip. The attention of the engine driver is riveted upon him—a life is in danger. The same steam though, which sends out the urgent warning obscures his view of the signal and when it is too late, he knows that the signal was against him. The crash, with loss of life and property follows. He saved another, himself he cannot save, but we, at least, can withhold blame.

There are many ways in which the cab windows can become obscured and so prevent the prompt or proper reading of signals. Certainly the cab window might be lowered, but if the night is cold or the speed high it is unnecessary to point out that the eye, even with its wonderfully protective mechanism, could not keep from watering and so soon prevent seeing altogether.

A locomotive is by no means automatic in operation; there is considerable driving to be done and unexpected difficulties to be overcome. Then again, to view a signal from the ground is simple, but it is a far different matter to read the same signal from a locomotive, speeding, swaying, jolting and jarring along at high speed; the shimmer of the heat also contributing to the attendant blurring of everything seen. A distant tin can, carelessly flung from a passing train, catches the rays of sunlight and flashes them back with blinding effect into the eyes. Everyone has experienced this effect of glare, which also occurs when sunlight is reflected from snow, sheets of water, and even from banks of green foliage. Where glare, with its attendant depression of the visual function is preventable, then early and urgent steps should be taken to eliminate such causes. Motormen of street cars, undoubtedly experience great annoyance from automobile headlights. Those at present in general use, or abuse, are a menace to pedestrians as well as to the street car passenger and early legislation should be sought which will remedy this evil. Light can and should be controlled and the inventor of a headlight which will eliminate the present objectionable feature of glare will find an aroused public eager to aid him in the successful marketing of his product, for unless glare is done away with, accidents will be of frequent occurrence. It is difficult to attach the blame where it belongs; certainly it does not belong to either the motorman or the street-car company although they are usually held to blame.

Other reasons for a more righteous judgment than that usually given might be advanced, but it is sufficient if we but bear in mind the thought that the men to whom when we travel, we must of necessity entrust our lives are but human, with limitations the same as we have, and when we are satisfied that everything has been done to insure public safety in travel and an accident still occurs, let us not in ignorance condemn, but rather pay tribute to those who risk and sometimes lose their lives in their attempt to satisfactorily serve all.

Watch and Serve

An aroused interest in the affairs of others may permit us the easier to anticipate our own opportunity. The electrical industry is so often the harbinger of progress in other industries, its success so often coexistent with theirs, that progress along any line should be carefully watched by manufacturers, jobbers, and others, that no opportunity be overlooked.

We all feel that we know just what opportunity is, but were we to realize that opportunity consists in the improvement of human service, conditions, or environment, it would be easier far to grasp it.

A long suffering public in a northern town asked for heated street cars during the winter-time, and a penurious manager, after saying, "You can't have 'em," or something equally abrupt, produced reams of figures to show that you couldn't do it anyhow. And so the public rode cold, and that was their attitude toward the "manager" who was soon "frozen out." But the public had it in for the company.

Then came one, young in years, inexperienced, but willing to serve, though at the same time he had an eye to economies. But to grab, is not to gain, and to withhold all is to lose all. He did not ride in a heated electric, but on the poor man's automobile—the street car—and he too, chilled to the marrow, objected.

"Why," he asked of his mechanics, "do you carelessly dissipate heat around the city which might be made to contribute to creature comfort? Strike off from beneath our cars these old-time rheostats and build for me new resistances to be installed within the cars where the heat they generate will contribute to the public good." And they did so, and the people rose up and called him blessed, and did laud his company. Moreover he made a fortune also from his invention, for he had grasped opportunity.

So will all obstacles vanish from the pathway of the man who would serve. Opportunity is the answer to need, and exists therefore wherever there is a need, actual or anticipated, which may be met. Do you seek opportunity? It is yours, up to the limit of your capabilities.

Do not call the other fellow lucky or more fortunate if he, watching the progress of other industries, grasps an opportunity which you, perhaps more closely associated with it, may have overlooked.

Making it easier or more pleasant for others, no matter what their occupation, will find new outlets for your wares.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

E. W. Rockafellow, general sales manager for the Western Electric Company, is at San Francisco.

Miles F. Steel of the Benjamin Electric Company, San Francisco, is on a business trip through Oregon.

H. Lewis of the Seger Electric Company, Fresno, Cal., spent a few days during the week in San Francisco.

Robert H. Parker, manager of the Butte office of the General Electric Company, spent a few days in Salt Lake City recently.

R. Reid, having completed his work as electrical engineer for the Waiahole Water Company of Hawaii, is now at San Francisco.

F. F. Skeel, western manager of the Crouse-Hinds Company, spent the past week at San Francisco and is now at Los Angeles.

W. W. Briggs, manager of the Great Western Power Company, San Francisco, spent the week on business in the Sacramento Valley.

Harry B. Lynch, manager of the Glendale Lighting Department, has been appointed manager of the proposed lighting plant of Burbank, Cal.

A. J. Selzer of the Adams Bagnall Electric Company, Cleveland, Ohio, is making a tour of the Pacific Coast and spent the week in San Francisco.

W. F. Neiman, sales manager of the Great Western Power Company, San Francisco, has left for a two weeks' business trip to Portland and the northwest country.

H. B. Squires of the H. B. Squires Company, San Francisco, returned the latter part of the week from a several days' business trip to Los Angeles and Southern California.

M. H. Gregg, formerly division manager for the United Light & Power Company at Oakland, Cal., is now division manager for the Sierra & San Francisco Power Company at Salinas, Cal.

A. V. Olson, of Pass & Seymour's San Francisco office, left the first of the week on a business trip to Portland, Seattle and other points in the northwest. He expects to be gone two months.

L. R. Jorgenson, engineer with F. G. Baum & Company, of San Francisco, is making a trip to Juneau, Alaska, to inspect the Jorgensen arched type dam being installed by the Alaska-Gastineau Mining Company.

P. B. Hyde of the Edison Storage Battery Company, San Francisco, is the proud possessor of a new son and heir. Reports indicate Hyde Jr. is doing well and on the road to join the ranks of electrical engineers.

W. L. Emmett, consulting engineer with the General Electric Company, and **W. J. Davis Jr.**, Pacific Coast engineer with the company, are in the Pacific Northwest, whence Mr. Emmett will return to Schenectady.

A. L. Appleton of the Appleton Electric Company left Chicago last week for a business trip to the Pacific Coast. He went by way of Vancouver, B. C., and is expected to arrive at San Francisco this week.

Paul B. Wilson, formerly district agent for the San Joaquin Light & Power Company at Alpaugh has been appointed district agent at Paso Robles, Cal., and **F. A. Easton** has been appointed district agent at Selma.

F. B. Clapp, who has been specializing on the sale of electric railway apparatus for the San Francisco office of the General Electric Company, will take charge of the construction of the suburban electrification of the Victorian Railways at Melbourne, Australia.

B. S. Josselyn, ex-president of the Portland Railway, Light & Power Company, was the guest of honor at an informal luncheon at the Imperial Hotel recently, at which members of the Jovian Order were the hosts. Mr. Josselyn, who leaves Portland next week for New York to engage in public utility work, was the recipient of a book containing a set of resolutions recently adopted by the Jovians, setting forth the regret of Mr. Josselyn's associates at his departure.

James Campbell, a St. Louis capitalist, who is among the heaviest stockholders in the Utah Power & Light Company, is in Salt Lake inspecting the interests of the company in Utah and Idaho. During his stay in Utah Mr. Campbell will be accompanied to the various interests of the Utah Power & Light Company by **P. B. Sawyer**, general manager of the company. Mr. Campbell said there was no connection with his visit and the proposed extensions of territory covered by the company. He said his trip was merely one of personal inspection of his investments and had nothing to do with the operations of the corporation.

H. E. Grant has resigned as sales manager with the San Francisco office of the Holophane Works to join the editorial staff of the Journal of Electricity, Power & Gas. Mr. Grant's electrical experience began in the British Isles in 1899 with the Isle of Thanet Light and Railway Company. After considerable construction experience he went to Canada and upon the formation of the Province of Alberta was chosen by Premier Rutherford to organize the new Department of Agriculture, later acting as first statistician. In 1907 he joined the British Columbia Electric Railway Company at Vancouver, remaining for a year in the engineering department and then resigning to join the commercial department as sales manager. Mr. Grant did effective work in this capacity for four years, when he resigned to take up illuminating engineering work with the Holophane Works for nearly two years. It is thus seen that Mr. Grant brings a wealth of practical experience to his new work which should be reflected in the pages of this journal. He is a member of the National Electric Light Association, being an active worker on the Committee for the Organization of the Industry, of the Illuminating Engineering Society and of the Jovian Order.

IN MEMORIAM.

FRANCIS VALENTINE TOLDERVY LEE.

Born—Winchester, New Hampshire, England, August 28, 1870.

Died—Victoria, B. C., Canada, August 17, 1913.

Son of Francis V. T. Lee of Shropshire, England, an Officer of The Queen's Own Light Infantry.

His school and college training was as follows:

Manchester Grammar School, Manchester, England.

College Communal, Boulogne, s.m., France.

Leland Stanford, Jr., University, California, was graduated 1897, B. A. in Electrical Engineering.

Assistant to Dr. F. A. C. Perrine, Prof. of Elec. Eng., 1893-1897.

Came to Sherbrooke, Canada, in 1887, and for the greater part of three years was in the service of the Canadian Pacific Railroad, as private secretary to the Division Superintendent. He resigned from railroad service to supplement that part of his school training that was taken abroad, with a more adequate technical training in this country. Shortly after his resignation he went to Victoria, B. C., and thence home to England on a trip, after which he returned to New York, where he entered the Manhattan Electric Company in order to gain experience that would enable him to test his liking for the specialty of electrical engineering. Here he came in contact with the late Dr. F. A. C. Perrine, and there resulted one of the great friendships of his life. Often a preceptor exercises a very great influence on the life and personality of a student, particularly is this true when they come as intimately in contact as did Dr. Perrine and Mr. Lee, who then was working his way through college, and assisted Dr. Perrine as secretary and general laboratory assistant. So

strong was Dr. Perrine's influence that many of Mr. Lee's old friends have often remarked on the little personal mannerisms, if they may be so called, that each acquired, unconsciously, doubtless, from the other.

Shortly after being graduated from the University he was appointed Assistant Engineer to John Martin, agent for the Pacific Coast Department of the Stanley Electric Manufacturing Company. He rose rapidly in this service, being appointed Engineer, January, 1898; Manager of the office in June, 1899, and a year later was made Vice President and General Manager of John Martin & Co., Electrical Engineers and Contractors, also District Pacific Coast Manager for the Stanley Electric Manufacturing Company, and many other Eastern manufacturers. During the above period there came under his direct supervision the erection of many of the earlier lighting and power plants that later were absorbed by the Bay Counties Power Company and the Pacific Electric Railway Company, for example.

Early in 1906 he severed his connection with John Martin & Co., but followed Mr. Martin's interests into the Pacific Gas & Electric Company where he was made Assistant to the President. As such he was generally responsible for the construction and operation of the hydro-electric developments of that company.

About three years ago he resigned from the service of the Pacific Gas & Electric Company to rest and to enjoy his well-earned competence. His last three years were play years, enjoyed fully in the close companionship of his wife and two daughters, with whom he spent these years abroad, in his old home in England, and traveling on the Continent. They returned a few months ago to Victoria, where he had intended to make his future residence.

On September 27, 1899, he was married to Edith K. Bonnallie of Sherbrooke, Quebec, Canada, who, with his two daughters, Ruth and Margaret, survives him.

Mr Lee died before much of his work, particularly that of the last seven years, had time to demonstrate its real worth. In all his business life his relations with the really big men with whom he worked, brought a mutual confidence and personal regard that in many cases amounted to a real affection. For the others, those of less caliber, he had a good-humored tolerance, although at times his path was made exceedingly rough.

His absolute faith in the kindliness of human nature was wonderful, for he had many rebuffs, but they never embittered him, and by habit he refused to believe any harm or evil of anyone until he had absolute proof of it. Many times he was heard to say "'They say', is a liar," and this he lived up to. Those who came intimately in contact with him knew the absolute integrity, the uprightness and the sweet disposition of him, and are thankful for the memory of him they cherish, and for the last three years he enjoyed so much.

His personal tastes were simple. The Fine Arts, of which he had a cultured enjoyment, appealed to him strongly. His reading covered a wide range, and having leisure he enjoyed his fine reference library to the full. A list of the works therein is an index of his versatility, and it a revelation even to his intimates.

At the time of his death he was a member of the American Society of Mechanical Engineers, the Institution of Electrical Engineers, the American Institute of Electrical Engineers, the American Gas Institute, the American Society of Civil Engineers, and the American Electro-Chemical Society. Also he was a member of Occidental Lodge No. 22, F. and A. M., of California Chapter, R. A. M., and a Knight Templar, member of Golden Gate Commandery, K. T., all of San Francisco.

A. H. BABCOCK.

Electrical Development and Jovian League of San Francisco.

At the regular weekly meeting held Tuesday the members were addressed by Mr. Percy V. Long, City Attorney. It was intended that Mayor James Rolph Jr. should be present, but owing to illness the Mayor could not be present, and Mr. Long appeared as his representative. The speaker took for his subject "Municipal Ownership," and dwelt in detail upon the municipal ownership of San Francisco's water supply, telling of what had been accomplished by the city in the undertaking and what was yet to be done.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The California & Oregon Telegraph Company, with main offices in Susanville, and operating in Lassen and Modoc counties, has applied for authority to lease the Nevada, California & Oregon Telephone & Telegraph Company, which operates in Plumas, Lassen and Modoc counties.

At the final hearing in the commissioners inquiry into telephone rates at San Jose, the commission's assistant engineer, A. R. Kelly, submitted his valuation of the company's plant in San Jose. A comparison with the company's own valuation follows: Kelly's valuation—San Jose only, $772,000; San Jose district, $823,000; company's valuation, $848,000 and $904,000 respectively.

The railroad commission issued a supplemental order granting authority to the Ojai Power Company to assume a note of $2500 in part payment for the properties of the Nordhoff Water Company.

A decision was rendered granting authority to the Midland Counties Public Service Corporation to purchase the franchises and properties of the Midland Counties Gas & Electric Company, the Paso Robles Water & Electric Company, and the Russel-Robison Water & Electric Company. The Midland Counties Public Service Corporation was also given authority to assume a bonded indebtedness of $821,000 of the underlying companies, and to issue $338,000 of bonds for additions and betterments.

A decision was rendered granting authority to the Pacific Gas & Electric Company to issue $7,000,000 of notes. The authorization enables the company to carry out its plan of financing as previously approved. The proceeds will be devoted largely to extensive hydroelectric development work.

The Pacific Telephone & Telegraph Company applied for authority to issue $3,000,000 of bonds. The company proposes to use approximately $1,850,000 to retire underlying bonds of the Sunset Telephone & Telegraph Company, and the balance for improvements in its system in San Francisco, Los Angeles, San Diego and Oakland.

A decision was rendered granting authority to the San Diego Consolidated Gas & Electric Company to issue $25,000 of bonds under a previous authorization.

NEWS OF OREGON RAILROAD COMMISSION.

The Oregon State Railroad Commission announces that within a few days it will fix standards for the measurement of quality, pressure and initial voltage of the public service companies in that state engaged in furnishing heat, light, water or power. It also will prescribe regulation for the examination and testing of the various products, in order to have accurate meters and appliances for measurement. It is planned to provide for an examination of all appliances and the commission will determine whether an appliance may be installed before it has been examined and found to be correct. It is probable that a reasonable fee will be charged for the testing, to be paid by the company affected. The commission also will establish fees to be paid by the consumer making complaint, who is to be reimbursed by the company affected if the appliance is found to be defective.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

CHANGES IN 1913 EDITION OF THE NATIONAL ELECTRICAL CODE.

BY F. D. WEBER.[1]

Changes made in the "National Electrical Code," Edition 1913, referring to the 1911 Edition as a basis of reference.

Added—Explanation on inside of cover.

Class A—Generators, Motors, Switchboards, Etc.

1. Generators.
   c—Third paragraph changed.
   d—Changed.
3. Switchboards.
   b—Changed.
   e—New, added.
4. Resistance Boxes and Equalizers—New Heading.
   b—New paragraph added.
   c—Changed.

8.—Motors.
   a—Second paragraph reworded.
   c—First paragraph reworded.
   c—Third and fifth paragraphs changed.
   e—Reworded.
   f—Reworded.
   f—Fourth paragraph added new.
   k—New added.

Class B—Outside Work.

Introductory paragraph—new and added.

12. Wires—Ground Return Wires.
   m—Omitted.
14. Transformers.
   a—Changed.
   b—Omitted.
15. Grounding Low—Potential Circuits.
   a—Changed.
   a—3. Fine print note omitted.
   b—Changed.
   b—3. Fine print note omitted.
   g—Changed—nearly all.

Class C—Inside Work.

Introductory paragraph new and added.

16. Wires, b—First paragraph changed.
17. Underground Conductors.
   d—Reworded.
18. Table of Allowable Carrying Capacities of Wires.
   Third paragraph changed.
   Third paragraph fine print note omitted.

CONSTANT-CURRENT SYSTEMS.

20. Wires.
   c—Reworded.

CONSTANT POTENTIAL SYSTEMS.

23. Automatic cut-outs.
   a—Added.
   d—Changed.
   e—Second paragraph changed.
24. Switches.
   a—Added to.
   b—Changed.
   d—Changed.

LOW POTENTIAL SYSTEM.

26. Wires.
   g—Added to, note omitted.
   h—Third paragraph omitted.
26. Wires.
   For moulding work (wooden and metal).
   k—Added to.
   l—Changed.
26. Wires.
   o—Third paragraph, changed wording.
   p—Third paragraph changed.
   For concealed "knob and tube" work.
   q—Added to.
   u—Changed.
27. Armored Cables.
   b—Third paragraph and fourth paragraph changed.
   c—Second paragraph fine print note, this paragraph, now required by code.
   Fifth paragraph fine print note added.
   d—Changed.
28. Interior Conduits, changed wording.
   b—Third paragraph added.
   d—First paragraph, part added. Third paragraph added. Fourth paragraph reworded.
   f—Second paragraph fine print note under this made part of code requirements. Last paragraph fine print note added.
29. Metal Mouldings.
   b—Second paragraph and third paragraph changed.
30. Fixtures.
   a—Third paragraph changed.
32. Flexible cord.
   e—Changed and added to.
34. Mercury vapor lamps, title changed.
36. Transformers. Oil transformers.
   a—Wording changed.
   Air cooled transformers: Fine print note made part of code requirements.
37. Decorative Lighting Systems, changed.
38. Theatre and moving picture establishments, wiring—wording changed.
   d—Footlights second paragraph, changed.
   e—Border and proscenium side lights, changed.
   i—Control for stage flues. Third paragraph changed.
   t—Auditorium. (1) changed.
   u—Moving picture equipments. Title changed. (2) changed. (6) changed.
   v—Added (new rules).
39. Outline Lighting. All rewritten.
   l—Changed
40. Car wiring and equipment of cars. Not included in this outline.
44. Wires.
   b—Wording changed.
45. Transformers, note omitted.
   Fine print note changed.
   c—Changed.

Class D—Fittings, Materials and Details of Construction.

50. Rubber-covered wire.
   b—Fine print note now required by code. Lead covered wires and cables for interior work only. added to.
54. Flexible Cord.
   Note changed under heading.
   c to l—Changed.
55. Fixture Wire.
   Note changed under heading.
57. Armored cables and cord changed.

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[1]Electrical Inspector Underwriters' Equitable Rating Bureau, Portland, Oregon.

58. Interior Conduits.
 Title changed.
 Note under heading changed, nearly all rewritten and added to.
59. Outlet Junction and Flush Switch Boxes.
 e—Changed.
 g—Changed.
62. Sizes.
 Fine print note omitted.
65. Switches.
 j—Marking changed.
 k—Spacings and dimensions changed.
 s—Test changed.
67. Link-Fuse Cut-outs.
 d—Omitted.
 Explanatory note omitted.
68. Fuses.
 f—Terminals.
 Table changed to new location.
 g—Dimensions table omitted.
 i—Marking, dimension table inserted.
69. Tablet and Panel Boards, heading changed.
70. Cabinets.
 a—Changed.
 Third paragraph rewritten and changed.
72. Sockets.
 a—Marking. Title changed and paragraph rewritten and changed.
 d—Ratings. Title changed and paragraph rewritten.
 e—Second paragraph. Last part of fine print note omitted.
 g—Changed.
 k—Changed.
 m—Putting together. Title changed also paragraph rewritten.
 n—Test, changed.
 p—Sockets of insulating material. Second paragraph added.
76, Insulating Joints. Rewritten.
77. Fixtures.
 Explanatory note changed.
 g—Added, new.
78. Rheostats, Resistance Boxes and Equalizers.
 c—Connections, changed. Fine print note omitted, changed and added.
 h—Tests. Third paragraph changed.
79. Auto-Starters.
 Explanatory fine print note added.
 b—Connectins, changed.
 e—Tests, changed.
81. Transformers. Rewritten and rearranged.

Class E—Miscellaneous.

88. Signaling Systems.
 e—Changed.
88. Insulators, resistance. Rewritten.
89. Soldering Fluid. Omitted.

Class F—Marine Work.

91. Wires.
 j—Second paragraph changed.
102. Interior Conduits.
 f—Changed.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION

The offices of the California Electrical Contractors' Association have been moved to the Rialto Building, San Francisco, where Secretary W. S. Handbridge will hereafter make his headquarters. Good progress is being made in the project to establish an exhibit of wiring devices in connection with the association's offices.

JOINT POLE CONSTRUCTION, PORTLAND, OREGON.

On September 26, 1913, the representatives of the various public utilities companies who are interested in "Joint Pole Occupancy," and the Joint Pole Committee of the Oregon Society of Engineers, met with Mr. Will H. Daly, Commissioner of Public Utilities of the City of Portland, for the purpose of considering the matter of the use of joint poles throughout the city. The city council having passed ordinance No. 27,786, gave Mr. Daly power to call this meeting. At the meeting it was decided to form a temporary organization of the members present, and at the first meeting form an organization electing a chairman and secretary. This committee to report at the end of sixty days to Mr. Daly, with a form of Joint Pole Contract and Specification, which would be agreeable to all parties interested.

POWER PERMIT FOR SOUTHERN CALIFORNIA EDISON COMPANY.

Secretary Houston has just granted a permit to the Southern California Edison Company for the development of additional electrical power on the Kern national forest. This company operates seven hydroelectric plants, one of which is on the Kern and five others on the Angeles national forest. The six plants on the national forests are capable of developing 37,000 horsepower, although there is not sufficient power in the streams to develop such an amount of power continuously. The company has installed, therefore, a number of auxiliary steam plants, which have a total capacity of about 54,000 horsepower.

The four projects mentioned in the permit are designated by the company as Kern River plants 2, 3, 4 and 5. It is expected that plant No. 3 will be the first to be put into operation, with 4, 5 and 2 following in the order given as the demands of the market increase. It is stated by the company that expensive dams will not be needed, but that the construction of some of the conduits will be difficult and will require considerable time. Because of this, and also because of the large investment required and the large amount of power that is involved in the development, the department of agriculture allows a period of almost 12 years before the plants will have to be in complete operation.

According to the estimates of the government's engineers the four new projects of the company will be able to supply almost 33,000 horsepower, except for a few days in a period of five years. Through the use of its steam auxiliary plants, however, the company will be able to obtain considerably more than that amount, and it is planned to install machinery which will have a total capacity of more than 80,000 horsepower. This will be transmitted at high tension by means of poles and steel towers over a maximum distance of about 155 miles from the plants to the city of Los Angeles.

NEW CATALOGUES.

The Dnucan Electric Manufacturing Company has issued Bulletin No. 28 on the Duncan Switchboard Watthour Meters for a.c. and d.c service. This bulletin contains much matter that should interest meter men, particularly on the subject of shunted types.

The Wagner Electric & Manufacturing Company, St. Louis, Mo., are distributing Bulletin 101, dealing with their various types of single-phase motors, and Bulletin 102, descriptive of their polyphase motors. These bulletins, each 15 pages, are profusely illustrated and contain much matter of interest.

The history of this line of motors is referred to and their construction and operating characteristics described in detail. Many interesting curves are given, bearing upon torque, speed, efficiency, power factor, etc. These bulletins should prove of considerable value to all interested in the installation of alternating current motors.

THE PASSING OF THE MILE AS A UNIT OF ELECTRICAL MEASUREMENT.

In the infancy of the electrical industry many units in general practice were naturally used to signify various quantities and conditions of the new form of energy. Many of the available units were not well suited to electrical measurements because electricity and the various industries to which it has given rise, have developed standards which are entirely different from all precedents. It was therefore necessary to devise new units in order to insure a better understanding of the actual conditions and to provide for greater efficiency in the long run.

It is undoubtedly because of this early necessity for breaking away from old traditions that the electrical engineering profession has always been among the first to adopt new methods and new units. A pertinent example is the invention and use of the circular mil, which has eliminated π from computations of the cross-sectional area of wires and cables. It now seems probable that the practically universal unit of length, the mile, is to be superseded by a standard of one thousand feet. Tables on costs and prices of wires and cables have been figured on this new basis for some time. Conductor resistance, particularly in the case of copper wire, is now commonly tabulated in ohms per thousand feet instead of in ohms per mile.

It is interesting to note in this connection that the Simplex Wire & Cable Company has recently abandoned the use of one mile as a unit of length for all factory measurements. This applies not only to conductor resistance but to insulation resistance (megohms per 1000 feet), capacity (microfarads per 1000 feet), and inductance (henrys per 1000 feet). By adopting one thousand feet as the unit of length for all electrical measurements at the Simplex factory and thus eliminating (from about a thousand calculations daily) the factor, 5280, an immense amount of figuring is avoided. In comparing the new standard with the mile, a close approximation for general use—involving an error of less than 6 per cent—is to multiply or divide the mile standards by five. For insulation resistance calculations, at least, a 6 per cent error is well within the limits of manufacture. In fact, as the change does not seriously conflict with former standards and is surely along the lines of simplicity and efficiency, there is apparently nothing but inertia to prevent its general acceptance.

OREGON POWER PROBLEM.

The following act has been filed with the secretary of state of Oregon relating to the Columbia River Power Project, providing for a detailed survey, investigation, co-operation and providing money therefor.

AN ACT.

Be It Enacted by the People of the State of Oregon:

Section 1. In order that the public interest in certain undeveloped water power, may be protected, and that detailed information as to cost of developing, transmitting and distributing such power in comparison with the cost of producing power from other agencies, may be definitely known as a basis for the adoption of some comprehensive policy with reference to the development of our water power resources, the legislative committee to consist of two members of the senate, to be appointed by the president, and two members of the house to be appointed by the speaker, who, when appointed, together with the state engineer, is hereby authorized on behalf of the state of Oregon, to enter into such contracts or agreements, with any officer or agent of the state of Washington, as may be found desirable to more economically carry out the provisions of this act. Such committee is also authorized to enter into contract with any federal department or bureau, if found desirable to more economically or efficiently carry out the provisions of this act.

Section 2. It shall be the duty of the committee named in Section 1 to prepare detailed plans, specifications, and estimates of cost for the maximum economical development of water power in the Columbia River, near The Dalles, at what is known as Five Mile Rapids. All available information relating to the project shall be collected and carefully checked as to its accuracy, sufficient borings shall be made at the proposed dam site and along the canal to ascertain the character of foundations, and detailed plans shall be prepared as a basis for estimating the cost. The committee shall prepare detailed estimates of cost, under certain assumed conditions, of transmitting such power to various points in Oregon and Washington, including cost of distribution to consumers. The committee shall also estimate the cost of producing power from other sources than water power, in order that the saving in cost, if any, may be apparent, and shall gather such other facts and information as may be of value to the public in the framing of some comprehensive water power policy.

Section 3. As soon as practicable after the completion of such surveys and investigations, the committee shall prepare, or cause to be prepared, a report setting forth the plans, specifications, and estimated cost of construction, maintenance and operation of such projects, together with any other information tending to show the feasibility of the same, and may, in its discretion, have such report printed in pamphlet form for gratuitous distribution to those interested. Copies of all completed maps, plans, specifications, estimates and reports secured or prepared in connection with any such investigation shall be kept on file in the office of the committee at all times, and shall be open for public inspection during business hours.

Section 4. There is hereby appropriated out of any money in the general fund of the state treasury, the sum of $15,000 to carry out the provisions of this act, which sum is to be expended on vouchers approved by the committee in the same manner as salaries of state officials are paid. The committee is hereby authorized to employ assistance, and to purchase material and supplies necessary in carrying out the provisions of this act.

TRADE NOTES.

Western Dry Battery Company, Seattle, has doubled the capacity of its factory by installing a new tamping machine.

American Woodpipe Company of Tacoma has finished the steam pipe casing for the Northwestern Electric Company's plant at Portland.

The Benjamin Electric Company, San Francisco, reports the arrival of the first shipment of their new model A Fordorn and model F battery horn for automobiles.

Herbert C. Moss, illuminating engineer, Seattle, has the contract for designing the electrical equipment in the cold and warm storage warehouse of the Seattle port commission.

Chas. C. Moore & Company, San Francisco are furnishing a "Smith-Vaile" 13 by 12 triplex pump for the city of Healdsburg waterworks system and a 10 by 12 pump of the same type for the city of Burbank.

Through the courtesy of the Board of Fire Underwriters of the Pacific Coast the 1913 edition of the "National Electric Code" has been mailed to all its members by the Electrical Development and Jovian League of San Francisco.

The Lushington Electric Company, Seattle, is wiring at 1209 Occidental avenue, for theatrical purposes. Semi-indirect lights will be used for the art glass effect. The company is also remodeling the lights in Sherman, Clay & Company building at Third and Pine streets.

NEWS NOTES

FINANCIAL.

BALBOA, CAL.—An election has been called for October 7th to vote an additional bonded indebtedness of $25,000 to pay expenses of putting in an 8 in. water main from the reservoir to Balboa.

SAN FRANCISCO, CAL.—The San Diego Consolidated Gas & Electric Company has applied to the railroad commission for authority to issue bonds of the face value of $25,000 under a previous authorization.

SAN FRANCISCO, CAL.—The Signal Hill Water Company of Long Beach has applied to the railroad commission for authority to issue 495 shares of capital stock. The stock was sold for non-payment of assessment, and the parties now desire to redeem it upon the payment of the assessment.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Company, a subsidiary of the Pacific Gas & Electric Company, has drawn by lot and will retire $100,000 face value of its $7,250,000 20-year 4½ per cent general mortgage bonds at 105 and accrued interest, November 1.

SAN FRANCISCO, CAL.—The entire issue of $330,000 bonds of the Stockton Gas & Electric Company have been called for January 1, 1914, at 105 and interest; but the Mercantile Trust Company of San Francisco has announced that it will pay that price for all bonds presented between now and that date.

SAN FRANCISCO, CAL.—The Sonoma Valley Water, Light & Power Company has applied to the railroad commission for authority to issue $30,000 in bonds, the proceeds to be used to pay off existing indebtedness and to make extensions to the system. The company serves the town of El Verano and vicinity.

ABERDEEN, WASH.—The following is a report on the various water and light projects: Project A—32-in. pipe line up Wishkah Valley, $350,000. Project B—32 in. pipe line up the Wynooche Valley, for gravity system, $780,000. Project C—32 in. pipe line up the Wynoochee River 10 miles and pumping station, $186,500. The second proposal is for a direct gravity system from the specified point on the Wynooche River to Aberdeen. Project C calls for a pumping plant on the Wynooche River. The report was referred to the water commission. The cost of the dam is estimated at $226,000, including penstock and machinery. Transmission line to pump house at $50,000.

ILLUMINATION.

GLADSTONE, ORE.—The city council has ordered the purchase of 15 bracket lamps.

COMPTON, CAL.—Sealed bids will be received up to October 7th for the purchase of an electric lighting and power franchise in Compton.

SACRAMENTO, CAL.—Bids have been asked by the city clerk for electroliers to be erected at Tenth and K streets, in accordance with a lighting district formed to take in the northwest corner.

NELSON, B. C.—The city council of Nelson has determined upon the purchase of a gas plant to cost $140,000. The council figures that it has made a good investment and that the plant will pay for itself.

NEW WESTMINSTER, B. C.—A by-law has been introduced at the city council appropriating $150,000 to purchase the plant of the local gas company, which is held under a 60 day option at that figure.

RAYMOND, WASH.—H. W. Urquhart of Chehalis and John Stewart of Seattle have made application to the city council for a franchise to construct and operate a gas plant. It is thought that the plant will require the immediate expenditure of $75,000.

LEWISTON, IDAHO.—William A. Baehr of Chicago announces plans to start work immediately on extensions and improvements that will cost in excess of $25,000 of the Great Falls Gas Company. The directors of the company are William A. Baehr of Chicago, Geo. H. Stanton of Great Falls, E. A. Potter, H. L. Hanley and T. J. Lucas of Chicago.

TACOMA, WASH.—The commercial section of the Tacoma municipal lighting department has offered to the city of Puyallup a 1-cent rate on power as against a 3-cent rate offered by Stone & Webster representatives. In this way a delay of two weeks was gained by the department in which to submit detailed estimates looking to the use of Tacoma power

BAKER, ORE.—Work has been started on the municipal lighting plant. The plant will cost about $25,000 and water from the city's system will be impounded for the motive power. It is planned to generate 1700 horsepower when the plant is complete. The work of construction will be directed by L. C. Standard of the firm of Standard & Richardson of Portland, who drew the plans.

LONG BEACH, CAL.—Ordinances have been adopted by the city council of Long Beach, ordering that systems of ornamental lighting standards equipped for use be constructed in American avenue, between Ocean avenue and Anaheim street; also along both sides of Broadway, between Alamitos avenue and Water street, in accordance with specifications and plans and ordinance requirements.

SOUTH VANCOUVER, B. C.—Reports on the construction of a municipal electric lighting plant and a municipal gas plant have been prepared for the city. The council has endorsed the report of Messrs. Coates & Hancock appointed to investigate the erection of a municipal gas plant which they say would cost $325,000. A suitable building would cost $250,000 while the laying of mains make up the aggregate of $325,000. The lowest cost to the consumer according to the engineers, for gas sold from such a plant would be $1.16 a thousand feet.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, Oliver T. Erickson, of the utilities committee of the city council, and Austin E. Griffiths, of the judiciary committee, Seattle, have been put on a committee to recommend a plan to either connect with Tacoma to take its surplus current, or to build a portion of the steam plant for which plans have been made. This part of the plant is to be built from the earnings of the existing plant until bonds are sold. It is expected that the gross earnings of the city lighting plant for the year will aggregate $1,074,500.

TRANSPORTATION.

PORTLAND, ORE.—Residents of the Mount Scott District have filed petitions requesting that the Portland Railway, Light & Power Company be compelled to extend a line to the cemetery.

VISALIA, CAL.—Sealed bids will be received by the clerk of the board of trustees up to October 5, 1913, for the sale of a 50-year franchise applied for by the Big Four Electric Railway Company.

RED LODGE, MONT.—A special committee of the Commercial Club voted to incorporate for an electric line to con-

nect Bear Creek coal fields and town of Washoe, and Bear Creek with Red Lodge; $100,000 in stock will be raised.

HELENA, MONT.—John D. Ryan, president of the Montana Reservoir & Irrigation Company, states that he will subscribe $50,000 toward the construction of interurban line to Hauser lake, providing citizens of Helena will raise additional amount to complete project.

BOISE, IDAHO.—The Idaho Traction Company has completed the installation of a 750-kw. motor-generator set for supplying direct current for the operation of their street railway system. With this additional transformer capacity available, the company will have provided for all present demands and a reserve for several years to come.

VANCOUVER, B. C.—It has been officially announced that arrangements are nearing completion for ordering four electric locomotives at an approximate cost of $75,000. Each locomotive is to be used on the Castlegar to Rossland line of the Canadian Pacific railroad. The electrification of this division is expected to overcome the difficulties met with now, by the unusual heavy grades and also a reduction in running time.

LOS ANGELES, CAL.—The board of public works has unanimously recommended to the city council that the Pacific Electric Railway Company be granted a 40-year franchise for its proposed elevated structure from the rear of the main street station to connect with the new San Pedro street line. The elevated railway will cost, together with right of way, close to $500,000. President Shoup of the Pacific Electric, states that steel contracts will be let as soon as franchises are absolutely assured.

FRESNO, CAL.—Announcement is made at the offices of the Fresno, Hanford & Summit Lake Railroad Company that bonds aggregating more than $200,000 have been voluntarily pledged by supporters of the interurban road and that construction on the first unit from this city to Selma will be started just as soon as material could be secured from the East. L. H. Jones, an engineer in whose hands now rests the management of the road, is at present in San Francisco securing prices on poles and ties for the line. The indebtedness of the road under the former management has been paid out in preferred stock and a new mortgage issued, but this act will have to be formally sanctioned by the railroad commissioners. It is announced that with every purchase of bonds stock would be issued at the rate of $500 in stock with $1000 purchase of bonds.

TELEPHONE AND TELEGRAPH.

GLENDIVE, MONT.—J. C. Owens, Billings, district manager American Telephone & Telegraph Company, is considering the feasibility of building an extension to Sidney. He states that additional circuit will probably be built next year between Glendive and Billings.

CLIFTON, ARIZ.—R. E. Pilloud, district manager Mountain States Telephone Company, with headquarters at Deming, N. M., states that his company, is preparing for improvement campaign that will include the entire renovation of the system at Clifton, and that high quality lines will be built between Clifton and Morenci, and between Clifton and Duncan. The entire equipment of the present service at Clifton will be discarded and new equipment of the best quality installed.

FLAGSTAFF, ARIZ.—District Commercial Superintendent McPhee and District Plant Superintendent Messner of the Western Union Telegraph Company, have made arrangements for the expenditure of from $4000 to $7000 on offices at Flagstaff. A new and complete battery of special type dynamos will be installed, and the present equipment will be replaced by the latest type instruments, also the furnishings of the office are to be replaced. The installation of new equipment will begin in about three months.

TRANSMISSION.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has begun the running of lines down through the White River valley to supply the homes of the district between Dwamish and Kent with electricity for light and power Most of the current will be used for lighting the farm buildings, water supply pumps and general utility motors on the farms. It is also preparing to serve the farmers residing near the Skagit-Bellingham interurban with electricity and wires have been strung for that purpose. It is proposed to extend the service to the Skagit and La Conner flats as soon as business will justify. The company now has a hydroelectric development of 53,750 kw. and an auxiliary steam plant with a capacity of 17,400 kw.

SAN FRANCISCO, CAL.—The application of the Oro Electric Corporation to the railroad commission for leave to contract with the Pacific Gas & Electric Company for power on a basis of seven mills per unit was opposed by the Northern California Power Company. That company now has in effect two contracts with the Oro, dated respectively October 5 and December 20, 1912. By the first of these the Oro is furnished with power in Butte, Yuba, Sutter and Yolo counties at the rate of 6 mills. By the latter the Oro agrees to take all the power needed by it in California exclusively from the Northern California Power Company at an agreed rate of 5 mills per unit. Allen Chickering, on behalf of the Western States Gas & Electric Company also opposed the Oro's new contract, as his company is now under contract with the Pacific to be supplied with power at 9 mills.

BOISE, IDAHO.—The Idaho Power and Light Company has taken over the holdings of the Beaver River Power Company in Boise and Southern Idaho, together with all the franchises of the latter company and its several power plants and power lines, the value of which is estimated at close to $1,000,000. L. L. Nunn, for years actively engaged in the development of electrical power, has been the prime mover in the deal by which the Beaver River Power Company passed out of existence so far as its operation in Idaho is concerned. This will limit the operations of this company hereafter to its system in Beaver County, Utah, with headquarters at Provo, Utah. L. L. Nunn is president of the new Idaho Power and Light Company; W. L. Biersach, treasurer; E. P. Bason, general manager. Mr. Nunn issued the following statement with reference to the recent move: "A new corporation has just been organized under the laws of the State of Nevada, by the name of the Idaho Power and Light Company. Its main offices are in Boise. This company has acquired the Idaho property of the Beaver River Power Company, including the 7500 horsepower station on the Malad River, the distribution systems of Boise and other Idaho towns. The franchise of the Beaver River Power Company to do business in Boise has been conveyed with the consent of the Mayor and City Council, to this company, which assumes all contracts made with the Beaver River Power Company's customers." The Beaver River Power Company started a genuine electric power war in Southwestern Idaho, particularly in Boise, when, two years ago, it first invaded this territory, then held by the Idaho-Oregon Light and Power Company, now the Southern Idaho Light and Power Company. After a hard fight a franchise was secured by the Beaver River people to operate in this city. The Southern Idaho Company controls all of the electric city and interurban lines in this territory, having recently merged them under the control of one holding company. The deal just closed to take over the Beaver River holdings in this State means that new capital has been placed behind it by President Nunn.

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POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

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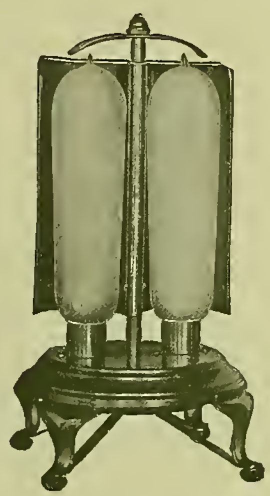
Where to Buy It in the West, Pages, 9, 10.

HOME COMFORTS



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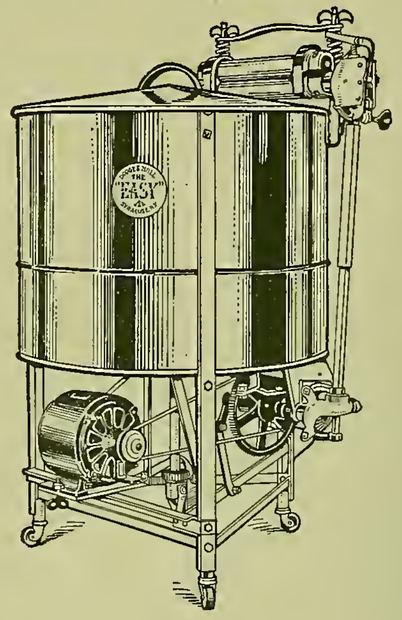

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Washing Machines

Motor Operated

are clothes savers.

The destructive feature of rubbing the garments is entirely eliminated, cleansing being done by vacuum and suction process.

Of solid copper construction.

Reversible ball - bearing wringer.

No wooden parts to rot or warp.

All mechanism beneath the tub out of harm's way.

EFFICIENT

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May be operated from any lamp socket

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SAN FRANCISCO OAKLAND LOS ANGELES PORTLAND SEATTLE

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI | SAN FRANCISCO, OCTOBER 11, 1913 | NUMBER 15

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NEW PLANT OF BEND WATER LIGHT & POWER CO.

BY J. C. BOGLE.

Nine years ago irrigation began the exploitation of Central Oregon. So rapidly did settlers flock into the new country, and consequent development obtain, that in 1910 two railroads were racing their construction through the canyon of the Deschutes to Bend, predetermined as the distributing city.

General View, Bend Water Light and Power Company Plant.

Any traveler along these roads, be he technically inclined or otherwise, is startled with a succession of available water powers. From Benham Falls to the mouth of the Deschutes the river splashes down a 4000 foot drop of elevation, an average of over 25 ft. per mile. The flowage is unbelievable. At Benham Falls the government gauge, maintained for four years, shows a minimum of 1800 sec. ft., and such is the steady supply to this river that during that period there has been no maximum flow in excess of three times the minimum. Grass grown banks corroborate the government report, which asserts that there has been no variation in stage more than 26 in.

Three years ago there was initiated at Bend a project contemplating an ultimate development of 1400 electrical h.p. The head works, including the dam, the spillway and the head gates, were completed. At this point the policy of the holding company decided it to discontinue for the present the course as originally outlined, and to supply meanwhile the

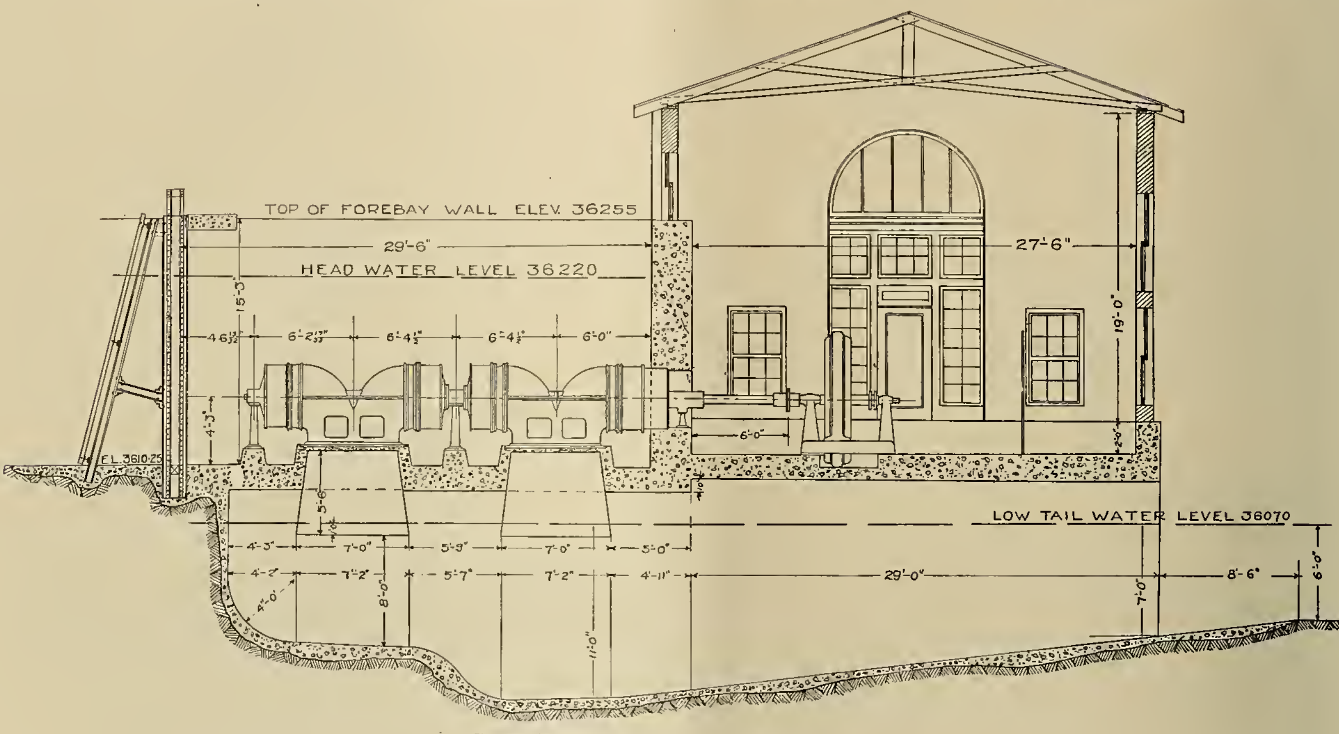
needs of a growing town with electric service from a temporary plant. This was done, and 150 kw. were realized.

Towns in the Northwest have surprising growth. In a short time the temporary plant was overloaded, and rapid enlargement was forcibly indicated. This work was undertaken by McMeen and Miller for the Central Oregon Power Company, which had recently come into possession of the property.

The dam is of the rock fill type, and extends from the west bank to the south end of the spillway. A levee containing the headgates connects the north end of the spillway with the east bank. These headgates were originally intended to communicate with a canal leading to the proposed power house.

vision has, however, been made for the rapid addition of another unit as soon as the load will warrant, and excavation has been completed for the half of the sub structure unbuilt. Construction will be carried on behind a gravity bulkhead already in place, which shuts off the river from the excavation.

The power house substructure is of reinforced slab construction. No attempt was made to place the wall plate, water bearing or draft tube rings coincident with the pouring of concrete, but by a system of tongued and grooved openings the parts were later grouted in place with no difficulty and with no subsequent leaks. The main shaft, being horizontal, pierces the cross wall and enters the generator room through a stuffing box. No waterproofing was used in



Cross-Sectional View of Bend Plant.

To continue the work as originally laid out met with the difficulty of building a forebay which would be of sufficient size, and yet in its construction not necessitate shutting down the plant already in service. Work was greatly cramped by the existence of the old flume, which necessarily had to be maintained during later construction. Obviously water had to be carried around the old flume to the new power house until the latter was carrying the load.

To accomplish this end there was constructed a battered concrete wall backed with counterforts, extending from the headgates to the new power house. Eventually this will retain the forebay, which will be simply an arm of the river, cut off at its lower end with an earth fill. But at present it is being used as one side of a flume, the other side being a timber bulkhead, spaced 13 ft. 6 in. from the wall and secured to it with rods and caps. This flume leads to the new power house and will be used until the forebay is put in service, after which time the timber bulkhead will be removed.

Only half the ultimate power house has been completed, and in that only one unit installed. Pro-

this wall other than separately mixed grout, which was carefully spaded next the forms to a thickness of one inch. The resulting wall is quite impervious.

Either wheel pit may be drained after shutting off the flow from the forebay. For this purpose stop logs are provided, and these slide vertically in slots having reinforced corners. Such an arrangement provides for closure at long intervals in an entirely satisfactory manner, and avoids the expense attendant upon the installation of gates and the necessary rigging to operate them.

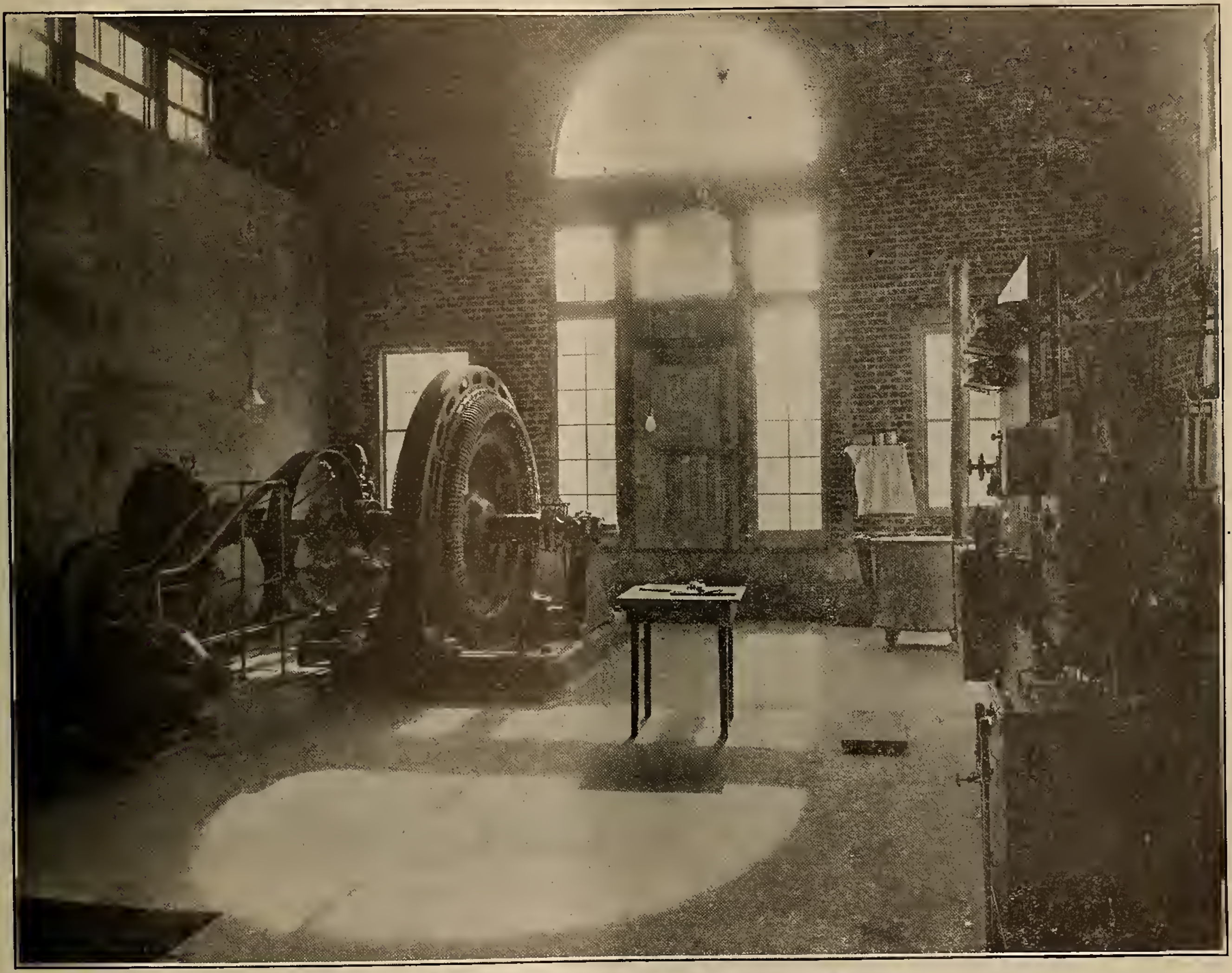
In this country anchor ice is a problem, frequently developing suddenly and with great speed. On several occasions racks have been obstructed between regular times of inspection, and at light loads the loss in head due to the obstruction will not evince itself immediately. With this in mind the racks were designed to carry considerable head. The anchor ice is spongy, and it is almost impossible to rake it from the racks. The most efficient method of dealing with it thus far found is to have the rack screens made sectional, and by opening the screen a section at a time to allow the spongy mass to pass through the

wheel. The greatest difficulty is encountered at about midnight, at which time the temperature is lowest and the velocity in the wheel pit the least. Next winter it may prove interesting to experiment with a water rheostat suspended in front of the racks. A good load and consequent velocity of water will be obtained and quite a large amount of heat available for fusion will thus be liberated at a critical point.

At present the plant is operating under 14 ft. head, which may be raised at any time to 17 ft.

In addition to the plant machinery, the generator room contains remote control of a motor driven pump for city water service, and a series arc rectifier set for magnetite street lamps with which the city is provided.

The plant was in operation 30 days after the substructure was finished, although it was necessary to transport the machinery completely around the temporary plant and to raise it into the building from the tail race level. All the turbine parts were elevated through the openings left for draft tubes. The generator had to be "snaked" up with a stump puller. Such an apparatus is easily obtainable in most localities, and will be found remarkably effective on small jobs. All erection was accomplished with chain blocks from an overhead timber, and at no time was the need for a crane in any part of the building at all apparent.



Interior View—Bend Watei Light and Power Company Plant.

The turbine, furnished by the S. Morgan Smith Company, is supported on two concrete beams which form a part of the wheel pit floor. It is quadruplex, with 30 in. wheels, and operates at 200 r.p.m.

Speed regulation is obtained with a Woodward oil pressure governor of 7000 ft. lb. capacity. As there is at present but one alternator on the line, the governor is adjusted to flat regulation. Oil pump and governor are belted from opposite sides of the main shaft, and both are located close in to the cross wall and well out of the way.

A 250 k.v.a. alternator, operating at 2300 volts is directly connected to the main shaft, to which the exciter is also belted. The exciter is designed to carry a slight overload when the alternator is fairly loaded. Alternator, switchboard and exciter are all General Electric Company make.

The installation of this first unit was made very satisfactorily and while ample for present requirements, a rapid growth of the plant is anticipated.

38,956,485 passengers were carried on suburban ferry and electric roads around San Francisco during the past fiscal year. This includes passengers from Market street ferry only, the passengers carried on other local electric interurban traffic not being counted.

THE AUTOMOBILE IN MODERN GAS DISTRIBUTION.

BY D. E. KEPPELMANN.

(In this article the author shows conclusively that remarkable savings in distribution costs are effected by the adoption of modern methods. Statistics of a representative company are given and the actual savings stated. This article was presented by Mr. Kepplemann at the recent convention of the Pacific Coast Gas Association at San Jose.—The Editor.)

All history has proven that when a limit to progression or development in any particular direction has been reached, further progress and development necessitates a radical departure from the former method of procedure.

The gas industry has met with unparalleled success, so much so that apparently further development along the old lines seemed impossible; however, with higher costs of both labor and material, increased taxes and decreased revenue for the same product, the engineer is compelled to develop a newer process to lessen the cost of production; and later methods for the distribution of such product.

One chief engineer, insists, that, modern gas distribution means "Maximum Results at Minimum Costs." With this in mind, and knowing the wonderful achievements of the past, to obtain the results insisted upon, surely necessitated with the change of conditions, a radical departure from former methods.

The "High cost of living," has been thoroughly analyzed and proven to be the "Cost of high living"; and just so, the "High cost of hauling" has been proven the "Cost of high hauling"; therefore overcoming high hauling costs has necessarily increased efficiency by the elimination of the cost of high labor, quite a factor in the results so necessary to enable us today, to compete with the increased cost of production and the decreased sale price of our product. Hence the advent of the automobile into the gas industry.

The introduction of the automobile, necessitated a complete reorganization and for your information a general outline of the old system and methods employed is given and compared with the new order of things, showing the remarkable results; not only the enormous saving in costs, but the perfect service rendered as well, both conditions, the goal for which every gas man strives.

Formerly there existed in San Francisco as the gas distribution under the management of various heads of departments, a main department, service department, meter department, complaint department, house pipe inspection department and a paving department; each with its supervision, its retinue of clerks, offices, telephone service and the various appurtenances necessary thereto. With the introduction of the automobile came the complete reorganization in which each of these departments mentioned, lost their identity entirely; a complete consolidation of all of these into one, creating a gas distribution department under one managing head, and resulting in the elimination of considerable supervision, clerks, telephone service, and other overhead charges, a big factor to be reckoned with, and the elimination of a vast amount of lost motion, which in itself must enhance the value of service rendered and lessen costs.

Fig. 1. Emergency Oxy-Acetylene Welding Outfit.

The San Francisco District of the Pacific Gas & Electric Company has upwards of 105,000 consumers, supplied through 712 miles of low pressure and 41 miles of high pressure mains, a total of 753 miles of mains, as follows:

Mileage of Mains.

High Pressure. Feet	High Pressure. Miles.	Size in.	Low Pressure. Feet.	Low Pressure. Miles
300	.05	1¼		
31,735	6.01	2	706,458	133.80
		2½	3,968	.75
17,608	3.33	3	338,537	64.11
20,725	3.93	4	1,686,806	319.47
55,739	10.56	6	501,421	94.96
1,835	.35	7		
35,305	6.68	8	176,569	33.44
		10	90,520	17.14
21,600	4.09	12	103,968	19.69
34,476	6.53	16	75,739	14.35
		18	1,835	.35
		20	7,400	1.40
		24	43,810	8.29
		30	22,770	4.31
219,323	41.53		3,759,801	712.06

The gas distribution department executes the following:

Installs new and overhauls and repairs mains, both high and low pressure.

Installs new, repairs and pumps main and service drips.

Builds governor pits, installs high pressure governors, attends to the maintenance of these, adjusting and the placing of pressure charts.

Locates and repairs leaks in street, both mains and services. Estimates on main line extensions, maintenance and repairs. Makes a systematic periodical survey of the entire system to prevent the possibility of an overload at peak load.

Installs new services, replaces services, extends, alters, cuts off, overhauls and repairs services, installs cutoff valve at curb, installs lamp posts and cuts in tee for large service connection.

Sets, removes, changes and changes position of meters.

Attends to complaints of leak at meter, meter connections and leaks in house pipes; complaints of no gas and poor pressure.

Attends to the inspection of the installation of all house piping.

Inspects the repaving of all trenches.

The staff consists of a superintendent, two assistant superintendents and six district foremen, which constitutes the supervision for the entire department. Each individual has risen from the ranks of this company, having been selected for both his practical and managerial ability. The city of San Francisco is divided into six districts, a district foreman in charge of each and he alone is held absolutely responsible for everything in that district pertaining to gas, beginning at the main in the street to the consumer's burner. One assistant superintendent covers a general inspection of all the rank and file in all the districts. The other assistant superintendent is the clearing house for everything received and sent from the department, assorts the mail and all work orders, dispatching each to its proper channel, supervises its proper disposition, covering the position of chief clerk and office records.

The main gangs, of which there are from ten to as high as fifteen gangs during the busy season, is in charge of a working foreman, under the direct supervision of the district foreman, entirely eliminating the "straw boss," and resulting in a saving amounting to from one thousand to fifteen hundred dollars per month.

The service gangs, two men to each gang, consisting of fitter and helper, numbering from thirty to seventy gangs, are assigned to districts and under the direct supervision of the district foreman in charge of the district.

Formerly all main foremen and service gangs reported to the shop each morning, each receiving their work for the day. Imagine not only the congestion but the enormous loss in actual working hours. The advent of the automobile has changed this enormous loss to an overwhelming saving in costs. Today no main foreman or service gang ever visits the shop, not even on pay day.

Each district foreman is provided with an automobile and he visits every main and service gang at least twice a day, assigned to him in his district. The district foreman delivers the orders to each gang, sees to the delivery of material for each job ahead of the arrival of the gang, attends to the pick up of surplus material, supervises every installation and delivers his pay checks on the job each pay day.

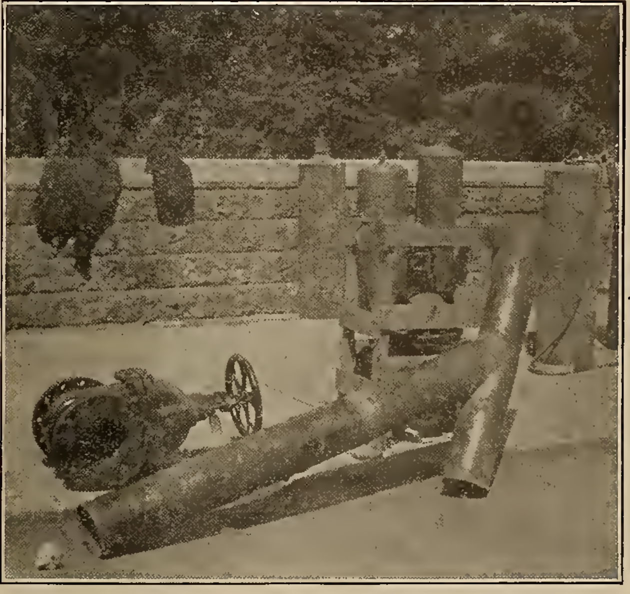


Fig. 2. Type of Welded Joint.

Here it must be observed that with the aid of the automobile, radical changes have been brought about, creating newer methods, a new system and causing an enormous saving in costs, a comparison of which will be shown later.

The taking up of lost motion, previously mentioned, will now be gone into more thoroughly.

Lost motion may be described as:

(1) Lost motion as between the commercial and distribution departments; (2) Lost motion as between the formerly existing departments; (3) Loss of time between the consumer's request for service and the rendition of such service.

Formerly it was necessary for the commercial department to call up various departments on the physical end to obtain information. Do you recall wanting information, calling up, and then learn the fact that you have the wrong department? Your line is switched to another department, and again find you have the wrong department for the particular information you desire. With the present practice you have but one office and one party to call for any infor-

mation, made possible by the consolidation of all the departments.

Lost motion as between the departments would mean the friction necessarily existing between these departments which became obsolete with the elimination of the departments. Some of you have had the personal experience when calling to set a meter found it physically impossible owing to some discrepancy in the piping as compared with the relative position of it, with a new service just installed. The service department blames the house pipe inspection department and they in turn blame the service department. In the meanwhile the meter department is waiting to set the meter and the prospective consumer having been drawn into the controversy, is waiting for gas, and the company pays quadruple the cost. With the present practice an occurrence of this character is impossible.

Loss of time between the consumer's request for service and the rendition of such service is of the utmost importance, it being imperative that any work of any nature whatsoever be completed as expeditiously as possible, both to the commercial department, to enable it to stimulate the confidence and good will of the public with which it deals and the distribution department in its saving in costs.

With various departments existing, an order for main line extension is sent to the main department who in turn send a main gang to install the main. A day or two elapses when another crew is dispatched to again dig up the street and install the service. Another day or two passes to allow one department to advise the other department, who finally sends out a meter man to set the meter, all of which covers a period of from six to twelve days. With the present practice, an order for main line extension is received from the commercial department, accompanied with all the service and meter orders intended to install. A crew is dispatched, who dig the street, lay the main, run the service, install the meter, back fill the trench and complete the work at one time.

The results in service rendered and saving in costs are indeed gratifying.

A meter having once been set, is not removed again except under the following conditions. A consumer moving, the commercial department closed the meter and again opens it upon notification from a new consumer. Several experienced men are employed by the commercial department, and each is supplied with an automobile.

Should a meter not be in use for a period of six months, it is removed, experience having proven that a longer period of inactivity is apt to interfere with its correctness. All meters are changed after being in constant use for six years.

Under former practice all complaints were received through a telephone board located in the commercial department, later dispatched by messenger to the distribution department. With a view of expediting the rendition of service, the management conceived the idea of placing the receipt of all complaints, immediately on the "Firing Line"; hence the removal of the complaint telephone board, from the commercial department to the distribution department.

The arrangement of the blank form used for complaints is herewith given.

GAS COMPLAINT.

Location ....

Name ....

Nature of Complaint ....

Kind of Place ....

Size of Service........Meter......Rise......

What Supplied ....

....

How Corrected ....

Remarks ....

....

Date Ordered........Time........By........

....

Complaint has been satisfactorily remedied.

....
(Signature of consumer.)

Date Completed........Inspector............

A complaint from the moment of its inception to its final completion necessitates careful, serious, intelligent handling. The idiosyncracies of a complaining public are too well known for comment here, nevertheless, whether a complaint is justifiable or not, it is of the utmost importance that it receive immediate and careful attention. Herein lies the secret of one of the company's larger assets or the source of never ceasing difficulties.

The city is divided into districts, the complaints segregated and a complaint man is held responsible for the condition of his district. He is selected for his knowledge of the business, his ability and is expected to display some degree of intelligence. He telephones from his district frequently, thereby being kept in constant advice as to any possible condition that might arise. All the initial information possible is exceedingly necessary, for it expedites the execution of the order. The nature of the complaint is imperative since a "Leak" necessarily establishes precedent over a "No Gas" or "Poor Gas," likewise the kind of place, as a hospital would precede a restaurant, or a restaurant precede a private dwelling. The complaint man possessed with such previous information is obviously better equipped. The "Size Service," "Size Meter," "Size Rise," "What Supplied," "How Corrected," and "Remarks," are intended for analysis purposes. After the execution of the orders, all complaints are returned to an expert who carefully diagnosis each case, observes the cause and its remedy; from whence it is directed for either some change or repair, or to the superintendent for further analysis or to the files. Filing is done with the greatest care, the clerk in charge being instructed to observe any previous complaints from the same location. This checks a repetition of orders, checks the quality of work as performed by the complaint man and prevents frequent complaints. A repair or replacement in this manner is attended to immediately, with considerably less annoyance to the consumer and at considerably less cost to the company.

Automobiles play an all important part in the handling of complaints, not only in costs, but furnishing rapid transportation, lessens the time between the consumers request for service and the giving of such service. It is an every day occurrence for the complaint man to be informed that the consumer had just phoned. Even should the automobile increase

costs rather than decrease, the excellence of the service given would more than warrant its use.

The automobile has been shown to be of inestimable value with regards to service rendered and the following tables giving a few comparative costs, should prove of added interest.

The installation of services shows a saving equally as well. The auditor of this company took one thousand services as installed under the former method. After computing the labor, material, teaming and paving found the average cost of each service to be $30.00. With the present practice the auditor used the same method with one thousand services picked at random and found the average cost per service $19.00, a net saving of $11.00 per service. During the year 1912, a total of 6893 new house services were installed, therefore, at a saving of $11.00 per service would mean a total saving of $75,823.00.

Cost to Lay 300 ft. of Pipe.

Soil	Paving.	Material.	Labor.	Team.	Total	New average cost per 100 ft. covering all conditions	Old average cost per 100 ft. covering all conditions.	Present saving in cost per 100 ft.
		2 in. W. I. Pipe.						
Sand	No paving	$10.60	$ 8.00	$ .50	$19.10			
Sand-Basalt	$16.50	10.60	15.00	.50	42.70			
Sand Bitumen	45.45	10.60	20.00	.50	76.55	$51.62	$68.00	$16.38
Rocky ground	No paving	10.60	21.00	.50	32.10			
Rocky ground-Basalt	16.50	10.60	25.00	.50	52.70			
Rocky ground-Bitumen	45.45	10.60	30.00	.50	86.60			
		3 in. W. I. Pipe.						
Sand	No paving	$23.30	$ 9.00	$1.00	$33.40			
Sand-Basalt	$16.60	23.30	16.00	1.00	57.00			
Sand-Bitumen	45.45	23.30	21.00	1.00	90.85	$65.93	$90.00	$24.07
Rocky ground	No paving	23.30	22.00	1.00	46.40			
Rocky ground-Basalt	16.60	23.30	26.00	1.00	67.00			
Rocky ground-Bitumen	45.45	23.30	31.00	1.00	100.85			
		4 in. C. I. Pipe.						
Sand	No paving	$40.25	$18.00	$2.50	$60.75			
Sand-Basalt	$19.95	40.25	26.00	2.50	88.70			
Sand-Bitumen	54.55	40.25	35.00	2.50	132.30	$100.25	$110.00	$9.75
Rocky ground	No paving	40.25	32.00	2.50	74.75			
Rocky ground-Basalt	19.95	40.25	42.00	2.50	103.70			
Rocky ground-Bitumen	54.55	40.25	44.00	2.50	141.30			
		6 in. C. I. Pipe.						
Sand	No paving	$61.60	$19.00	$3.40	$84.00			
Sand-Basalt	$19.95	61.60	27.00	3.40	111.95			
Sand-Bitumen	54.55	61.60	35.00	3.40	154.55	$127.00	$134.00	$7.00
Rocky ground	No paving	61.60	40.00	3.40	105.00			
Rocky ground-Basalt	19.95	61.60	48.00	3.40	132.95			
Rocky ground-Bitumen	54.55	61.60	56.00	3.40	175.55			
		8 in. C. I. Pipe.						
Sand	No paving	$80.11	$25.00	$3.40	$108.50			
Sand-Basalt	$19.95	80.11	40.00	3.40	143.46			
Sand-Bitumen	54.55	80.11	46.00	3.40	184.06	$153.00	$166.00	$13.00
Rocky ground	No paving	80.11	45.00	3.40	128.50			
Rocky ground-Basalt	19.95	80.11	52.00	3.40	155.45			
Rocky ground-Bitumen	54.55	80.11	60.00	3.40	198.06			
		12 in. C. I. Pipe.						
Sand	No paving	$148.05	$40.00	$3.60	$191.65			
Sand-Basalt	$24.90	148.05	65.00	3.60	241.55			
Sand-Bitumen	68.06	148.05	70.00	3.60	289.71	$250.47	$273.00	$22.53
Rocky ground	No paving	148.05	72.00	3.60	223.65			
Rocky ground-Basalt	24.90	148.05	78.00	3.60	254.55			
Rocky ground-Bitumen	68.06	148.05	82.00	3.60	301.71			

Note:—Cast iron pipe increased $6.00 per 100 ft. Labor increased $0.25 per day.

During the year August 1, 1912, to August 1, 1913, the following low pressure mains were installed.

	2 in. W. I.	3 in. W. I.	4 in. C. I.	6 in. C. I.	8 in. C. I.	12 in. C. I.
	Length in Feet.					
Aug.	23,230	5,633	1,415	580		
Sept.	25,005	1,012	4,452			
Oct.	48,448	3,170	9,026	156	470	
Nov.	43,174	13,253	7,308	42		
Dec.	36,182	305	6,693	3,848		2,619
Jan.	6,943		7,727	24		
Feb	15,524	15,700	7,107	478		
March	28,752	11,685	8,106	23	12	
April	17,314		26,854	847	209	
May	13,707	1,539	4,284	6,668	1,620	312
June	2,145		4,807	80		834
July	7,585	22,258	27,791	24		
	268,009	74,555	115,570	12,770	2,311	3,765

We now have the number of feet laid, and the saving in cost per foot, with the following net savings for new mains installed for the period of one year.

Size.	Kind.	Ft. Installed.	Saving Cost per ft.	Total Saving.
2 in.	W. I.	268,009	$0.16	$42,881.44
3 in.	W. I.	74,555	0.24	17,893.20
4 in.	C. I.	115,570	0.10	11,557.00
6 in.	C. I.	12,770	0.07	893.00
8 in.	C. I.	2,311	0.13	300.43
12 in.	C. I.	3,765	0.22	828.30
				$74,353.37

Showing a total saving for the year of $74,353.37 on the installation of low pressure mains. High pressure is not shown here since the method of connection was entirely changed, this will however be taken up later.

Fig. 3. Governor Connection.

Meters set, removed and changed, miscellaneous work, complaints, etc., are tabulated as follows, showing the number of orders operated on.

RECAPITULATION FOR YEAR 1912.

Date.	Sets.	Outs.	Unlocks.	Locks.	Close to Party.	Miscellaneous Work.	Change Meter.	Complaints.	Total Tags.	Total Cost of Labor.	Cost per Tag.
1912	19,156	6,964	2,260	1.038	524	43,617	12,993	127,588	214,140	39,982.80	.17+

This form is used as a daily guide and is intended to show the average cost per completed tag for labor only. Herein is credited only the orders actually completed while the total labor is shown. Under former practice the average cost per order for labor was $0.40. With present practice the average cost per order for labor is $0.17, a net saving of $0.23 per order. During the year 214,140 orders were handled, with a saving of $0.23 per order, or a total saving for the year 1912, amounting to $49,252.20.

We show a net saving for the year of $211,428.57 which does not include the installation of lamp post, services, nor repairs of any nature to mains, services, or meters.

High pressure main costs have not previously been shown due to the entirely different method of connection. Formerly couplings were used with rubber or other gaskets, making an expensive and in some respects an unsatisfactory joint. After exhaustive tests, following the initial work of Mr. L. B. Jones, assistant engineer gas department, these were welded together with the oxygen-acetylene process; a method reluctantly started, but now adopted and followed with the greatest enthusiasm. Such wonderful results have been obtained that no distribution department will in future be complete without a welding outfit. A fitting of any size or shape is made on the job with the same pipe at the time it is required, costing from 50 per cent to 75 per cent less.

For comparative costs, a main recently installed with the welded joints is given in detail as compared with a main laid with couplings installed the year previous.

No. of Feet.	Labor.	Material. Supplies, Sundries.	Teaming.	Total.	Cost per Foot.
		8-Inch O. D. Welded.			
4,770	$2,305.59	$2,609.55	$125.00	$5,040.14	$1.06
		8-Inch O. D. with Joints.			
4,350	$2,527.70	$2,476.55	$89.00	$5093.44	$1.17

During the installation of the line with joints, laborers received $2.50 per day, while during the installation of the welded joints, laborers were paid $2.75 per day an increase of 25c per day per laborer.

With the foregoing comparison it will be observed that the welded main was installed at 11c per foot cheaper than the jointed main; making a net saving of $524.70 on a small installation. It must be realized what the enormous saving would be on large installations. The jointed main will require maintenance, owing to the disintegration of the gasket, with the necessary labor and repaving cost added, while the welded main will never require any further attention or further cost.

The half-tones show in part the great flexibility of the oxy-acetylene process.

One picture taken, but not suitable for reproduction, shows 14 lengths, each 40 ft., a total of 560 ft. of main, welded on top of the ground and afterwards rolled promiscuously into the ditch. This is a portion of the 8 in. line being laid at the present time, a total of 33,000 ft., welded its entire length. This line supplies two governor pits, all the connections to the pits, connections to the drips and even the drips are welded throughout. A test on 20,000 ft. laid showed only one small pin hole leak.

The style of fittings so readily made on the job are shown in Fig. 2. Apparently difficult connections are made with ease; a valve with I. D. pipe on an angle may be welded to O. D. pipe also on an angle, and just in the position it is required.

Fig. 3 shows a governor connection. The companion flange being standard, is screwed on to a piece of standard pipe, then welded to the tubing.

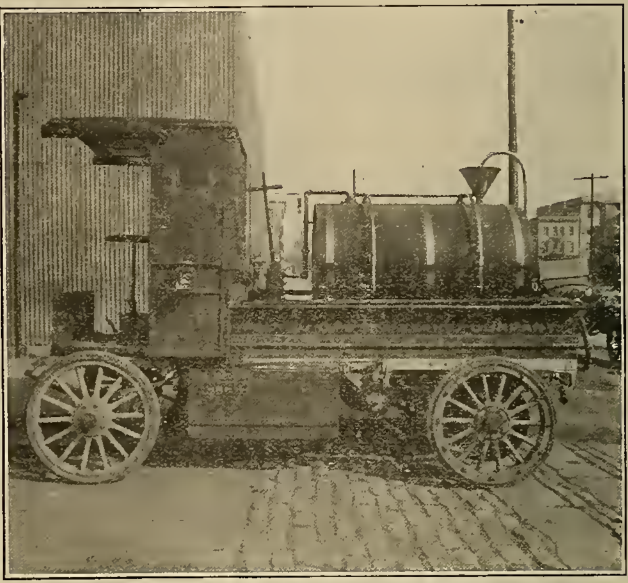


Fig. 4. Electric Car for Pumping Drips.

A drip may be made of the same pipe on the job and welded into position. Plates are welded on the end, thus closing it, and the stand piece for blowing the drip is welded. No saddles are used, instead a hole is burnt in the tubing and the stand piece welded through it. This eliminates the special high pressure drip at 50 per cent less cost.

The Panama-Pacific International Exposition will be the first world's fair to be supplied entirely with high pressure gas. Knowing of the inadequate supply of gas at other world's fairs, Mr. E. C. Jones, chief engineer of the gas department of the Pacific Gas & Electric Company, has designed a system of high pressure mains, which will positively insure a sufficient supply of gas at all times. The system will consist of 15,000 ft. of 8 in. steel tubing, supplied from two 8 in. connections off the 16 in. high pressure line now connecting the Potrero gas plant with North Beach. This 8 in. line will make a continuous loop around the Fair, 4 in. laterals being supplied from it. The high pressure lines will be extended into the various buildings, where district governors will be installed to reduce the pressure, connecting to the house lines at this point.

This entire installation consisting of pipe, fittings, drips and drip connections, and governor connections, will be welded throughout.

The Pacific Gas & Electric Company owns and operates approximately 175 motor cars and trucks, both electric and gasoline, 20 of which are assigned to the gas distribution department at the present time. The near future will undoubtedly see the complete motorization of the company's entire equipment.

Fig. 4 shows the type of electric car used for pumping drips.

The car shown in Fig. 1 is equipped for emergency welding and has covered 20,000 miles in the past two years without any loss of time due to mechanical trouble.

The writer has only endeavored to show the results derived as we have experienced. The question of automobiles vs. horses is no longer an experiment; for today the call for the automobile is greater than ever, throughout the world. Exhaustive research has been carried on by the larger governments and by almost every line of industry throughout the civilized world. That the automobile has made good, is beyond the question of a doubt. Automobile manufacturers have been designing with the idea of producing a moderate priced car that would combine the salient features of economy, durability and reliability; and that they have succeeded from every point of view is a fact, proven by every known test.

The principal advantages of automobile over horse drawn equipment, greater endurance, greater load capacities, speed, economics effected and service rendered more than warrant the discontinuing of the inefficient horse system of transportation. Changed economic conditions demands the utilization of motor equipment, just as the advance of civilization demanded the telephone, typewriter, elevator and other institutions in our daily life that have become too common now to be considered more than necessities.

The motor car is faster, surer, independent of weather extremes, independent of fatigue, independent of hours for rest and feed, free from bad temper, occupying less space in streets, docks, terminals and the garage, doing cleaner work, permitting the employment of more skilled and efficient labor, staying on the job without stops for twenty-four hours if required, these are a few conditions which more than offset the large initial expenditure, with its interest on the investment, its depreciation, maintenance and cost of upkeep.

Mistakes have been made by manufacturers of motor equipment, causing unnecessary expense, troubles and annoyance, but a truer analysis of these difficulties involves the human element; however, with the co-operation of the manufacturer and persistent, careful educational training of the operator is bringing the motor car to a point of maximum efficiency.

Not only have vast improvements in construction been made but research work along the lines of cheaper fuel will bring about greater economy of operation. In recent tests kerosene has proven successful, as well as benzol, to some extent, while benzol brought to a higher efficiency, which is undoubtedly possible, will indeed produce wonderful results beneficial to the gas industry.

THE TRUCK.—TYPE AND POSSIBILITIES.

BY R. B. MATEER.

(The author of this paper presents an array of figures and facts showing the advantage of automobile over horse-drawn delivery systems, and shows where each type of motor vehicle proves superior. The paper was presented by Mr. Mateer at the last meeting of the Alameda County Electrical Development League.—The Editor.)

Some manufacturers refer, when in a reminiscent mood, to the economies effected by the use of automatic machinery, others laud the advantages of centralization in operating, accounting and management, but few have attempted to analyze the cost of delivering the finished product from mill to warehouse, from manufacturer to consumer, or considered the value of the motor propelled vehicle over that at present in use. Decreased cost of production whether accomplished by an increase in output, possible with modern machinery or by the elimination of the human element in the handling of the raw material is not the limit to be attained in any industry. What of your delivery system? What is your cost per mile with the present horse drawn vehicle? Why not improve the efficiency of the system by substituting gasoline or electrically propelled vehicles? Their use is not confined to any particular industry, nor is their application limited except by the radius of operation As a general rule, the electrically driven machine is best for city service, parcel delivery where frequent stops are necessary, and for trucking, also where the streets are in a fair condition, while the gasoline propelled vehicle is superior for long hauls over rough roads and in open country. A few of the more important advantages of each vehicle, classified as to its motive power are discussed under the following headings: Initial investment, limits-distance covered, maintenance, operating economy, the fleet, and conclusion.

Gasoline, List Price.	Capacity.	Electric, List Price.
$1500.00	500 to 1000 lbs.	$1715.00
1750.00	1001 to 2000 lbs.	1815.00
2700.00	2500 to 3000 lbs.	2230.00
2800.00	3001 to 4000 lbs.	2430.00
3500.00	4001 to 5000 lbs.	2910.00
4000.00	5001 to 7000 lbs.	3380.00

The figures quoted represent an average price of commercial vehicles both gas and electrically operated and if the experience of the past three years is a criterion of the next few years, the increased output will warrant material reductions. Prior to 1911, the average price of an electric truck was $3369, while today the same machine can be purchased at an average of $2422, or $947 less than advocates of a modern transportation paid then.

When purchasing a vehicle the first cost should not be considered of importance when deciding on the type of machine. The essential features to be considered are economy, efficiency and reliability.

Limits.

Electric.—On a single charge, small trucks will travel seventy-five miles, sufficient for general use, though 93 miles has been obtained. Large trucks easily cover a mileage of from 25 to 30 on a single charge, sufficient under the present conditions for city hauling. The electric is at present limited as to radius (1) by battery capacity, (2) absence of charging stations in suburban sections, where battery renewals may be obtained.

Gasoline.—A vehicle of the internal combustion type; is limited as to the distance covered by its ability to obtain gasoline and water. As fuel and water can be secured easily in the open country the gasoline truck seems at present the best suited for long hauls in the country or for interurban purposes.

Under this classification of expense, may be included such items as tires, repairs, battery and lubricants. A recent synopsis of the investigations at the Massachusetts Institute of Technology, show the following average costs of tire renewals per mile.

Gasoline.	Capacity.	Electric.
$0.09	10,000 lbs.	$0.08
.04	6,000 lbs.	.035

It was noted that, where vehicles are equipped with pneumatic tires, the mileage expense was double that for solid tire equipment.

Battery repairs, cleaning and renewals vary with the electric truck in proportion to the capacity of the vehicle. Comparison of five trucks are noted.

Capacity of Truck

	1000 lbs.	2000 lbs.	3000 lbs.	4000 lbs.	7000 lbs.
Battery, repairs, etc...	$130.50	$175.36	$219.34	$271.54	$312.84
Mechanical upkeep....	67.54	84.15	101.70	110.96	121.42

Comprehensive figures of the annual cost of upkeep, repairs, etc., of gasoline vehicles are not available, primarily by reason of the frequent minor items, that precede a general overhauling. It is apparent though that where a car has been thoroughly overhauled the expense is far in excess of the average guarantee, varying from 1 ½to 2 times the manufacturers figures.

It is the summation of all items, interest, depreciation, maintenance, operating expenses, etc., which when compared with the tonnage hauled and the mileage covered shows such a decided economy in favor of the electric vehicle over that of its competitors, for city and suburban purposes. Statistics recently compiled and published by the Doherty Operating Company convincingly establish the electric truck as the vehicle of the present day for all general delivery and trucking purposes within a reasonable radius.

The comparative figures are quoted on a two horse wagon, a 1000 lb. electric truck, a 2000 lb. electric truck, and a 5000 lb. electric truck.

Costs of Electric Trucks and Two-Horse Wagon.

	Two-Horse Wagon, 5000-lb. Capacity.	5000-lb. Electric Truck.	2000-lb. Electric Truck.	1000-lb. Electric Truck.
Av. trips per day......	4	8	8	9
Mileage per day........	12	24	20	20
Mileage per month (loaded half way).......	312	624	520	520
Av. load per trip, lb..	4.000	5,500	2,500	900
Total load per day, lb..	16,000	44,000	20,000	8,100
Tons	8	22	10	4.05
Total load per month, tons of 2000 lb.....	208	572	260	105.3
Total cost per month..	$280.74	$211.11	$187.81	$180.93
Cost per mile..........	0.899	0.338	0.361	0.347
Cost per mile (omitting driver's and helper's wages)	0.499	0.138	0:121	0.107

Other operating data shows a five-ton truck in Boston, Mass., to save 12.5 per cent on short hauls and 41 per cent on trips of from 12 to 15 miles.

Another 3½ ton truck in Lawrence, Mass., the past year showed an economy equal to 24 per cent over horse haulage, while a recent report on the value of electric trucks, used for government purposes, shows a sum saved in one year's time sufficient to cover not only the purchase but all the operating expenses for a twelve-month period of a second machine.

The truck used was of 2500 lb. and the figures quoted are those recently prepared by Mr. W. H. Metz of Washington, D. C.

2500-lb. Electric Truck.

Cost of truck..............................	$2,230.00	
Labor for charging batteries		$ 46.44
Charging		16.50
Acid		18.00
Rubber jars		15.00
Batteries (partly renewed)...........................		64.98
Carbon brushes		1.80
Repairs		99.96
One operator at $2.48 per day..........................		776.24
Two laborers at $1.92 per day..........................		1,201.92
Totals	$2,230.00	$2,240.84
Depreciation, 10 per cent.................................		$ 223.00
Interest on investment, 2 per cent......................		44.60
Total cost		$2,508.44
Total mileage per year ...'................................		3,366
Cost per mile		$ 0.745
This truck displaced five horses and carts, as follows:		
5 carts by contract at $1.92 per day.....................		$3,004.80
5 laborers at $.192 per day each..........................		3,004.80
Total		$6,009.60
Net saving of truck over horses per year...............		$3,501.16

Fleets.

Influenced by the long life of the electric vehicle, its low up keep and minimum operating cost, large firms have, after an impartial trial, ordered many electric trucks.

A few of the electric fleets, and the number of vehicles composing them are:

American Express Company..................................	252
Ward Bread Company...	200
Carson Pirie & Scott..	125
United States Government	81
Ward Corby Company	64
Pacific Gas & Electric Company...........................	175
Fleischman & Co., Cincinnati..............................	25
Fleischman & Co., Baltimore...............................	15
Manilla Railway & Light Company........................	16
Hale Bros.	8

Each stands as a survivor of the criticism of competitors and the cry of the "knocker," who did not understand the period of trial.

Influenced by the demand in city and county, those agencies, formerly handling only pleasure vehicles have added a line of gasoline or electrically propelled trucks, and are even now arranging to supply vehicles on time payments, overcoming what is possibly the greatest obstacle to the growth of the industry —"cash down."

Conclusion.

With agencies alive to the possibilities of both the electric and gasoline truck co-operating with their customer as to service and time payments it is surprising that quasi public utilities in this district hesitate to do their share in promoting the use of electrically propelled vehicles. Perhaps it is through a misunderstanding of the value of such a charging load —which is generally three times as attractive as that of the average motor. Perhaps it is ignorance on the part of the customer as to his operating cost, in either case but one solution is possible, viz.: an active, aggressive campaign by public utility in co-operation with the dealer. Will the members of this league boost, aye, demand of utility their co-operation in developing everything electrical.

ELECTRICAL PUMPING AND IRRIGATION

THE SELECTION AND INSTALLATION OF A SMALL PUMPING PLANT.

[Continued.]

BY B. A. ETCHEVERRY.

Adaptability of the Several Types of Pumps for Small Pumping Plants.

Where the source of water supply is a stream or surface body of water, the choice is usually between a power pump and a centrifugal pump and will depend largely on the lift and capacity. Power pumps are best adapted to high heads above 75 ft. and to small or moderate volumes of water, usually under 200 gal. per min. For these conditions the efficiency of a power pump is usually greater than that of a centrifugal pump. For greater volumes the plunger pumps are comparatively expensive and centrifugal pumps are usually preferable unless the lift is excessive. The centrifugal pump has the advantage that it is simple in construction with no parts to get out of order, and that it is cheaper than a power pump.

Where the source of water supply is ground water with the water table in the well at a depth below the surface not much greater or less than the limit of suction lift, so that a deep pit is not necessary, then the choice is between a centrifugal pump, a power pump and an air lift pump. The selection between the centrifugal and power pump will depend on a consideration of lift and capacity as explained above. Air lift plants have low efficiency, require a depth of well below the water table equal to about twice the lift measured from the water table and are hardly to be considered in connection with separate small pumping plants. They are best adapted to a large number of wells (at least six or preferably more) placed close together.

Where the source of water is ground water developed by deep wells with the water table at a large depth below the surface (50 to 200 ft. or more) the choice is between a vertical centrifugal pump in a pit and a deep well pump which eliminates the pit. Deep well pumps are best adapted where the lift is in excess of 100 or 150 ft. and for wells that do not yield more than about 400 gal. per minute. Their efficiency is greater than that of centrifugal pumps, but the cost of repairs and depreciation is greater.

The selection should be made only after careful consideration of the first cost of the pump and the annual cost of fuel, operation and maintenance. Where the lift is high, the fuel cost will be considerable and it is good economy not to select the cheapest pump obtainable, but one that is guaranteed for its efficiency. On the other hand, if the pump is to be operated only during a very small portion of the season, it would be poor economy to invest a large capital in a high grade pumping plant to save in fuel cost.

Methods of Driving.

The driving power is generally either gasoline engine, steam engine, or electric motor. Centrifugal pumps are usually either direct connected (except for varying low heads) or connected by means of belts, gears, or chains. Power pumps are connected by belts or gears. Direct connection is preferable when possible; it is more efficient and eliminates the adjustment of belt or chain necessary with belt or chain driven pumps. The connection of these pumps and driving power must be such that the pumps will be given the speed or number of revolutions per minute for which they are designed and for which the highest efficiency is obtained. For this reason direct connection can only be used where the driving power and the pump have the same speed. The speed of centrifugal pumps is usually high; so is that of electric motors; and for this reason they can, if properly designed, be direct connected. This is done usually by means of a flexible coupling. Gasoline and steam engines are generally operated at a much lower speed than centrifugal pumps, and are therefore not direct connected unless the engine and pump are specially designed. This is done by some manufacturers. Because power plunger pumps are operated at a low speed, they too, are not direct connected to the driving power. When connected by gears, belts or chains, the driving gear and driven gear, or the driving pulley and driven pulley must be so proportioned that the pump will be given correct speed. When a plunger pump is built with a steam engine in a single machine, with the piston or plunger of the water cylinder on the driving rod as the piston of the steam cylinder, it is called a direct acting steam pump. The fuel consumption of a steam pump is greater than that of a steam driven power pump and so steam pumps are not considered.

Deep well pumps are usually equipped with gears and levers combined and connected with the driving rods of the pump, forming what is called the pump head, the object of which is to convert and transmit the circular motion of the driving power to the driving rods of the pump. The engine or motor is usually connected to the pump head by belts, but may be connected by means of gears. In some cases steam heads are provided in the place of the pump head.

The power necessary to lift water is indicated in horsepower. A horse power represents the energy required to lift 33,000 pounds 1 ft. high in one minute; this is equivalent to 3960 gal. of water per minute raised one foot high. This relation enables one to find the net horsepower required in any case by multiplying the discharge of the pump in gallons per minute by the total lift in feet and dividing by 3960. The result obtained represents the useful water horsepower necessary to lift the water. The horsepower delivered by the engine to the belt or gears when the pump is belted or geared to the engine, or to the pump itself when direct connected is the brake horsepower, and must be greater than the useful water horsepower to allow for the loss of energy in the pump and transmission. The horsepower developed within the engine

itself is the indicated horsepower, and must be greater than the brake horsepower to allow for the energy loss in the engine itself. Gasoline engines and motors are rated on brake horsepower, but gasoline engines are frequently overrated. Steam engines are rated on indicated horsepower.

The combined efficiency of a pumping plant represents the ratio of the useful water horsepower to the rated horsepower of the engine, and will vary considerably with the type of pump, method of connection of engine with pump, and the care taken in operating both pump and engine at the proper speed. In ordinary field practice a good pumping plant, properly installed, should easily reach the efficiency given in the following table.

Efficiency of Centrifugal Pumping Plants and Brake Horsepower per Foot of Lift.

No. of centrifugal pump.	Discharge in U. S. gal. per min.	Water horsepower per ft. of lift.	Efficiency. Per cent.	Brake horsepower per ft. lift.
2	100	.025	30	.081
2½	150	.038	35	.11
3	225	.057	40	.14
3½	300	.08	45	.18
4	400	.10	45	.22
5	700	.17	50	.34
6	900	.23	50	.46
7	1200	.31	50	.62
8	1600	.41	55	.75

The efficiency of power plunger pumps varies with the size of the pump and with the lift. A greater efficiency is obtained with the higher lifts and with the larger sizes. The efficiencies of properly installed plunger pumps and the horsepower for various lifts are given in the following table:

Diameter of cylinder.	Length of Stroke.	Capacity in U. S. gals per min.		Efficiency and Brake Horsepower for Lifts of 50 ft.	100 ft.	150ft.	200ft.	250ft.
3 in.	4 in.	18	Efficiency	.30	.40	.42	.45	.45
			Horsepower	.75	1.1	1.6	2.0	2.5
4	4	32	Efficiency	.35	.50	.60	.65	.65
			Horsepower	1.2	1.5	2.0	2.5	3.1
4	6	50	Efficiency	.35	.50	.60	.65	.65
			Horsepower	1.9	2.5	3.1	4.0	4.8
5	6	76	Efficiency	.40	.55	.65	.70	.70
			Horsepower	2.4	3.5	4.4	5.5	6.7
5	8	90	Efficiency	.40	.55	.65	.70	.72
			Horsepower	2.8	4.1	5.2	6.5	7.8
6	8	131	Efficiency	.45	.60	.65	.70	.72
			Horsepower	3.6	5.5	7.5	9.3	11.4
7	8	180	Efficiency	.45	.60	.65	.70	.72
			Horsepower	5.0	7.5	10.5	13.	15.5
7	10	210	Efficiency	.50	.65	.70	.75	.78
			Horsepower	5.25	8.0	11.	14.	.17
8	10	270	Efficiency	.50	.65	.70	.75	.78
			Horsepower	6.75	10.25	14.50	18.25	22.1
9	10	340	Efficiency	.50	.65	.70	.75	.78
			Horsepower	8.5	13.	18.	23.	28.

The plant efficiency of deep well pumping plants as ordinarily installed and operated was found from measurements made on a number of pumping plants in Southern California to be from 35 to 55 per cent. With proper installation and operation the plant efficiency or ratio between useful water horsepower and brake horsepower should be from 50 to 65 per cent.

The plant efficiency of air lift pumps expressed as the ratio between the useful water horsepower and the indicated horsepower in the engine cylinder was found from test on a number of such plants in Southern California to average a little less than 20 per cent.

The above tables will give the size of the engine. The driving power may be either a gasoline engine, steam engine, or electric motor. The methods of connecting the engine with the pump have been already considered. Other factors being equal, direct connection is preferable when possible. A few general considerations of the types of engine are given in the following paragraphs.

For small plants irrigating a few acres, the steam engine, although very reliable, is not so commonly used as the gasoline engine except where coal or oil is very cheap as compared to gasoline. However, for larger areas and where coal or oil is cheap, it may be more economical than either a gasoline engine or electric motor. For large plants operated continuously it may be economy to install an efficient boiler and a high grade compound condensing, triple expansion, or quadruple expansion, steam engine, in order to decrease the fuel cost. For small plants operated only for short periods during the irrigation season it is much more important to decrease the cost of installation. The interest on the capital invested and the depreciation of the plant are very important items of cost as compared to the fuel cost. For these reasons, unless the acreage is large and the lift very high, the steam plant should consist of a semi-portable locomotive type boiler and an ordinary slide valve steam engine.

A gasoline engine is fairly reliable if it is strongly built and operated with care. Cleanliness and proper attention are necessary. All parts and bearings should be kept in fine adjustment and properly oiled, by examining the engine at least every two or three hours. The circulating water should be kept fairly hot, but not too hot. It should be nearly boiling as it comes out of the jacket. The engine should be regulated by means of a governor to give the proper speed to the pump. To keep down the fuel consumption the gasoline feed should be so adjusted that there will be a miss in every ten or twelve explosions, and the engine should be worked up to its full rated capacity. Over 75 per cent of the troubles in connection with gasoline engines are due to the sparking device. This can usually be remedied by cleaning all connections free from oil, scraping the ends of wires, tightening screws or replacing the batteries.

Electric motors are reliable and easy to operate, requiring very little attention.

The irrigation pumping system of the Utah Lake Irrigation Company is now completed and the company is ready to deliver water to farmers with whom contracts have been made. This plant, which is the second largest irrigation pumping plant to be installed in Utah, is located on the west shore of Utah Lake, a fresh water lake approximately thirty miles long and eighteen miles wide, lying in Utah County. The water is lifted by centrifugal pumps into a canal 150 ft. above the lake level, and from this point is carried by means of open canals, tunnels and flumes through the narrows of the river into Salt Lake Valley. The present pump installation has a capacity of 36 cu. ft. per second, and will ultimately be increased to a capacity of 100 cu. ft. a second. Electric power is purchased from the Utah Power and Light Company.

THE STATE OF CALIFORNIA WORKMEN'S COMPENSATION ACT.[1]

BY J. R. MOLONY.

The conditions in California with respect to the Workmen's Compensation Laws prior to the fall of 1911 were somewhat peculiar as compared with the conditions in other states of the union. As you all know, throughout the entire United States employers in the past have been answerable to their employes in damages in only those cases in which the employer had failed in some duty owing by him to his employe. In other words, unless an accident could be shown to have occurred by reason of the negligent act, or failure to act, of the employer or a vice-principal, there was no responsibility on his part arising out of such an accident. Furthermore, as you know, a number of defenses had grown up in all the common law states which made it possible for the employer to defeat recovery in a large number of cases in which his own negligence had contributed to the cause of the accident. That is to say, where both the employer and employe were guilty of negligence, there could be no recovery on the part of the employe, as the courts refused to look into the degree of negligence attributable to either party. In the next place, where an accident was caused by the negligent act of a fellow servant there could be no recovery. This is so well understood that it needs no comment. The third major defense was that of the assumption of risk which was available to an employer in many instances. These defenses had been evolved to an extreme degree in the State of California, owing to local conditions and the interpretation of these defenses by the local courts, and as a result there were less recoveries against employers in California than in almost any other state where the employers were less favored through the interpretation of these common law defenses. The result was that employers in California had been subjected to a very much lower insurance cost than employers in other states. Consequently when restrictions in these defenses were undertaken and put into effect, a very much higher percentage of increase in insurance rates was necessary in California than in other states where employers have been forced to pay higher rates in the past than those in effect in California.

The first material restriction in these defenses came with the Roseberry Law on September 1, 1911. This statute was an elective workmen's compensation act, the first section of which imposed an additional common law responsibility upon the employers by the waiver of their defenses in all cases where the employer did not voluntarily accept the provisions of the workmen's compensation portion of the law. Having placed this added responsibility on the employer in common law actions, it was believed that these interests would voluntarily accept the compensation provisions of the balance of the act. The result, however, was not to the satisfaction of the authors of this bill, owing to the fact that through lack of investigation, experience and knowledge of the subject, they incorporated a schedule of compensation benefits so costly as to make the insurance under the compensation portion of the act exceedingly expensive when compared with the insurance under the employers' liability portion. Therefore, after a year's experience, it became apparent that some radical change was required if compensation were to become at all common in California. Shortly after the discovery of this fact the administration submitted in October, 1912, a constitutional amendment to the electorate of California authorizing the adoption of a compulsory workmen's compensation act applicable to all classes of employment. Following that, the Industrial Accident Board appointed to administer the workmen's compensation benefits under the Roseberry Law, was empowered to draft an act to be submitted to the legislative session in January, 1913, for their approval. With one year's preparation the Industrial Accident Board submitted the Act which ultimately became known as Senate Bill 905, introduced by Senator Boynton.

The condition in other states in America was somewhat similar to that in California so far as the realization of the necessity for a change from the common law doctrines to that of workmen's compensation, except that Eastern states had advanced far beyond California. Until this year employers in those states had given very much more thought to this subject than employers locally, and a great deal more discussion had been had on the entire subject, with the result that most Eastern states have been forced to move more slowly than has California during this transition period. Naturally, under these conditions in other states, employers have had more time to adjust themselves to these changes; more time to inform themselves as to the desirability of proposed laws and have been able to form better conclusions than has been possible where so short a time has been given to the consideration of a subject as complex as this.

As to the question of the desirability of the change from the old doctrine to the workmen's compensation theory, there is little dispute. This has been accepted by practically all of the continental countries; has been accepted in varying degree by a dozen or more of our own states and seems to be admitted by the majority of the employing element as well as practically the entire employed element. On the question of the method of the change, there has been an extremely large number of divergent opinions and undoubtedly there will continue to be for years to come, although the best thinkers on the subject have conceded the necessity of making haste slowly, lest serious mistakes be made, which would ultimately imperil the success of any plan undertaken. The continental countries, Germany being the leading exponent of compulsory compensation, have been experimenting with a change in method of treatment of industrial accidents for from ten to thirty years, and in no country abroad are conditions satisfactory, even at this late date. Consequently does it not occur to you that serious mistakes may have been made in any statute so hastily prepared as this? Is it reasonable to expect that an inexperienced board, without one member on it or one advisor of it having had a day's practical experience in the insurance business, could work out an insurance scheme which would not be crude and which would not be dangerous in the extreme? However, we find ourselves with this Act on the statute books and with the immediate necessity of preparing for operation under it. I do not wish to be misunderstood in any critical remarks which I may make concerning the Act itself. We are faced with the necessity of dealing with industrial accidents in accordance with the terms laid down in this Act. It behooves us all to inform ourselves to the fullest extent possible, of the requirements of the Act and to do our utmost in co-operating with the state authorities in the administration of it. Should this not be done, the serious difficulties which must be encountered in a proper administration of it will be multiplied ten-fold. I want to say at this time that in my opinion there has never been an act put on the statute books of any state except California, that will require so much in the way of honest co-operation on the part of the employers and insurance carriers if disastrous consequences are to be avoided.

We undertook to point out difficulties in the administration of this Act to legislative committees in charge of this bill in its passage, but were unsuccessful in securing any material amendments to it and the bill now stands practically as it was originally drafted.

[To be continued.]

[1]Address given before California State Association of Electrical Contractors, at Santa Barbara, Cal.

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CONTENTS

Does this Encourage or Rebuke

Ever "the old order changeth." In the light of larger knowledge the old order is seen to have been disorder and it is therefore the part of wisdom that we yield to the new. The article, Gas Distribution and the Part Played by the Modern Automobile, which appears in this issue is timely. It gives statistics of savings which are astounding; is not only good theoretically, but is practical,—being an account of the actual; and is at once an encouragement and a rebuke.

The industries issue advertisements innumerable advising the consumer to adopt modern methods and so secure more hours for leisure occupations and personal improvement combined with profit, but can it be said that they too follow the advice they would give?

It is still of frequent occurrence to find delivery rigs of gas and electric establishments hauled by clothes horses or something equally antiquated.

But fill them with the unfamiliar juice,
(Whether Gas or Electric)
Methinks they might speed up, Sir! By-
and-By.

Forgetting the story of the "One Hoss Shay" the establishments supporting these antiquated delivery systems promise themselves that someday,—when the rig wears out, or the "hoss" drops dead,—they will inaugurate an auto delivery system, but in the meantime, they lose sight of the fact that it is imperative. if they would stay with the leaders, that they adopt now the better way which progress makes possible.

So it is that poor service, higher costs and consequent disagreement and loss prevail where better service, competitive costs, and pleased patrons should much more prevail.

The economy and desirability of the methods mentioned other than that of the automobile delivery are equally momentous and instructive. The resourcefulness of the writer of the paper and the accuracy of the information and statistics given, invest the article with especial interest and an authority which should not be questioned.

Every branch of the electrical industry also, could profitably investigate delivery statistics and costs bearing upon their own particular occupations, for as is shown elsewhere in this issue, the day has past in which it can truthfully be said that the economical application of the electric truck to city delivery is not within the limits of practice.

"With recognition of the error the remedy will invariably be suggested and the intelligent prosecution of this is progress."

The Remedy

What may aptly be termed the contemptible conclusions of commercialized "science," are occasionally scattered broadcast throughout the country and as these sometimes carry with them the authority of an engineering society through having been affirmed at some convention, such conclusions although erroneous and unfair are

nevertheless almost invariably accepted by the layman, or by those who do not have the opportunity to hear the discussions nor the privilege of first hand and independent research.

Almost invariably, too, such papers though proven unfair in discussion are printed in the transactions of the society, making unnecessary bulk and preventing more profitable reading. The best that should happen to such mistaken papers is that they be abstracted, for we do not want bulk in such publications, but facts.

The annual proceedings of almost all engineering societies run into many thousand pages and he is indeed fortunate who can find sufficient time to wade through all in an endeavor to extract the kernel. When it comes to reprinting in the technical press the papers presented, how the blue pencil aches to make its mark; so much that is said is unnecessary both in article and discussion.

This suggests the importance of the adoption by all engineering societies of the system of making reports of all kinds to its members through committees. If a member suggests a topic or the society would have a certain phase of a subject properly presented, let the individual to read the paper be selected, then at the same time appoint a committee or refer the matter to an existing committee representing all interests bearing upon the subject of the paper, to work in co-operation with the author so that accuracy be ensured and the unnecessary left out.

Truths disseminated increase business, but untruths eventually hamper.

There is no reason, too, why an incoming executive of a society should not, through being well informed by the secretary, immediately appoint members to prepare papers or the next convention, in this way giving more time for deliberation and preparation and for the committee to secure the widest possible co-operation of the other members. Incidentally should a member refuse to co-operate with such committees he is unworthy membership and should more quickly lose the advantages of membership than if he refused to pay dues.

This is important, for only active interest can keep a society alive or even justify its existence. One man interest and individual grand-stand plays won't do; intelligent, co-operative, and honest action must obtain.

When an expert has done his best in the preparation of a paper and some other perhaps non-technical person appointed to prepare the papers for publication commences to change the sentence construction and eliminate certain passages, there may ensue considerable confusion, and dissatisfaction, but if this same matter were referred, as suggested, to an all-round committee, then the paper would gain rather than lose by such changes, with the consequent satisfaction; and the further probabilities are that the high business peak at conventions would rapidly reach the normal, and much more profitable papers be intelligently presented and discussed.

In any event, such an arrangement would make for a more honest purpose and output and the disgrace of manipulating science to commercial ends would soon become unknown.

Corporate Personality

Every corporation has a personality which it assumes by virtue of its corporate existence under the laws of the land, but the distinctive personality accorded, is due to the actions of individuals at the point of contact with the public, whether it be executive, salesman, office boy or other employee, for to the public, the employee is the corporation.

It follows that if each official and employee is efficient, courteous, honest, and progressive, then the corporation will be known as one giving good service, considerate of its patrons, honest, and progressive also, but on the other hand, if the officials or only a few employees are inefficient, discourteous, dishonest, or otherwise regardless of the requirements of their office, then the corporation is dubbed dishonest, inefficient, grasping, and soul-less, by a suspicious public altogether too eager to look on the worst side, no matter how good the intent and purposes of the more faithful employees may be.

A public service corporation is a trust, and the sooner the component parts of the corporation recognize the importance of living up to that trust,—and of getting out of the "trust busting" game—the better for all concerned. Apathy or neglect on the part of officials and employees may be responsible for more "trust busting" of public service corporations from within than occurs from without.

The officials of public service corporations should direct considerable effort towards the development of a corporate personality at once pleasing to the public and profitable to themselves.

The officials and employees of public service corporations should realize the importance of giving good service; of being efficient, courteous, honest, and considerate of their patrons, for it is through them that the real personality of their corporation is expressed. So they become a part of the corporation. If it is an inefficient, grasping, soul-less or dishonest concern, that is the stigma which must become attached to them personally and only through them can such shame be expunged. A realization of their oneness with the concern should inspire the deepest loyalty and call forth their utmost endeavors.

Similarly the public should not too rashly condemn a corporation because of the acts of an individual employee; one perhaps whose length of service has not been sufficient for him to have become imbued with the spirit of the corporate personality of which he has become a part. To blame many for the acts or omissions of one is an injustice. The better way is to take steps to correct the one delinquent that the many be not blamed, for only in this way can the corporation's pleasing personality be preserved and public opinion reflect back to it the approval it would obtain.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

A. J. Selzer, newly-appointed sales manager A. B. Company, is at San Francisco.

C. R. Downs, Amador Light & Power Company, was a visitor at San Francisco last week.

F. J. Cram, sales manager, Electric Appliance Company, is on a visit to Olympia, Wash.

N. R. Chown and **R. B. Valette** have joined the sales force of the Electric Appliance Company.

R. D. Holabird of Holabird, Reynolds Company, San Francisco, left for an extended trip through the East.

J. B. Lukes, representing Stone & Webster interests, is on a business visit to the Truckee Power Plant, Reno.

Miles F. Steel, Benjamin Electric Manufacturing Company, is at Seattle and will make other northwest cities.

H. F. Jackson, general manager Sierra & San Francisco Power Company, has left for a month's trip throughout the East.

J. G. Pomeroy, Illinois Electric Company, Los Angeles, returned last week from a business trip to Chicago and other points East.

T. M. Stateler, salesman for the Pacific States Electric Company, San Francisco, is on a business trip through southern California.

Geo. Gray, representative of Crouse, Hinds Company, San Francisco, has recently become the proud father of a little daughter.

Fred Skeel, sales manager for Crouse, Hinds Company, Chicago, has returned to San Francisco from a trip through southern California.

Herman Stelzner of Lubeck, Germany, representing the Draeger Oxygen Apparatus Company, is at San Francisco on company business.

C. E. Roesch, representing Adams, Hollopeter & Mallet, has returned from a successful business trip throughout Southern California.

A. E. Wishon, assistant manager San Joaquin Light & Power Company, made a business trip to San Francisco during the past week.

H. V. Carter, president of the Pacific States Electric Company, San Francisco, recently returned from a trip through the Pacific Northwest.

H. W. Bliven of the Harvey Hubbell Company, arrived Wednesday from the East on business and expects to spend several days in San Francisco.

Jas. Pomeroy, formerly sales manager A. B. Company, is at Los Angeles, where he intends to commence in business as a manufacturers' agent.

Chas. N. Black, vice-president and general manager United Railroads, San Francisco, has left to attend the Street Railway Convention at Atlantic City.

A. E. Garland, industrial engineer for Fairbanks, Morse & Company, Indianapolis, is at San Francisco in connection with a special machinery installation.

W. L. Goodwin, vice-president of the Pacific States Electric Company, San Francisco, returned from a short trip to Los Angeles the first part of the week.

L. H. Thomas, formerly in the electrical department of George B. Adair & Son Company, Seattle, is now with the Brookings Lumber & Box Company, Highland, California.

R. B. Clapp, Jovian Statesman at Los Angeles, has resigned his position with the Westinghouse Electric & Manufacturing Company, and will shortly go into business as manufacturers' agent.

A. H. Halloran, managing editor, Journal of Electricity, San Francisco, and Statesman for California of the Jovian Order, left last Wednesday for the East, where he will attend the Jovian Convention at New York.

J. H. Moseley, advertising manager, Journal of Electricity, San Francisco, was a recent departure for the East on business. While there he will make arrangements for the opening of branch offices in Chicago and New York.

E. W. Rockafellow, general sales manager Western Electric Company, who is visiting the Pacific Coast, returned the first part of the week from a several days' trip through southern California.

Sylvester A. Baker, Western manager, Macbeth, Evans Glass Company, has returned to San Francisco, having made a business trip through southern California. Mr. Baker reports that business is good.

W. E. Boken, assistant superintendent municipal railroads, San Francisco, will act as head of the road during the absence of **Superintendent Thos. A. Cashin**, who has gone East to study street railroad methods of Eastern cities.

J. O. Presbey, formerly connected with the Cleveland office, Holophane Works of the General Electric Company, will fill the position made vacant by **H. E. Grant**, who resigned to join the Journal staff. Mr. Presbey will immediately cover the western territory.

Dr. T. Addison, Pacific Coast manager General Electric Company, has returned to San Francisco. While in the East Dr. Addison attended the convention of the Edison Illuminating Society held at Cooperstown, N. Y., and also visited the general offices of the company.

Ed. Norton, district sales manager of the Pacific States Electric Company, Seattle, recently joined the ranks of benedicts. The newly-weds were the recipients of many handsome gifts. **W. L. Goodwin**, vice-president of the firm at San Francisco, and wife, were among the guests present.

Mortimer Fleishhacker, **Guy C. Earl**, **W. W. Briggs** and **W. F. Neiman** of the Great Western Power Company, paid a visit to Oakland during the past week and were there entertained by **F. H. Woodward**, the local manager. All were very much impressed with the business outlook in Alameda and Contra Costa counties.

E. M. Cutting, of the Edison Storage Battery Company, San Francisco, will shortly leave for Chicago to attend the annual convention of the Association of Railway Electrical Engineers, and of the Electric Vehicle Association in that city, and while east intends also to visit the Edison Storage Battery Factory at Orange, N. J.

F. C. Dolson, who has been engaged in special irrigation work for the Pacific Power & Light Company, of Portland, during the past year and who has been connected with many of the hydroelectric developments of the Pacific Coast and Mexico, is making an extended trip through Central and South America in the interests of manufacturers of American machinery. Mr. Dolson will travel via Panama, and will spend several days in New York prior to sailing for Rio de Janiero.

OBITUARY.

Roger Kemp, manager of the Washington Electric Company, Spokane, and of the Montana Electric Company, Butte, died a few days ago at his home in Butte.

MEETING NOTICES.

American Gas Institute.

A joint meeting of the Illuminating Engineering Society and the American Gas Institute will be held at the Hotel Jefferson, Richmond, Va., on October 17, 1913.

Oregon Society of Engineers.

The annual reunion dinner of the Oregon Society of Engineers at the Portland Commercial Club on the evening of September 13, was a very enjoyable affair, the interest

being increased by a number of short talks given by the members.

San Francisco Electrical Development League.

A very enjoyable luncheon was served at the regular meeting place after which W. S. Berry, chairman, introduced Mr. John Ginty, assessor, City and County of San Francisco, who delivered an interesting address regarding the work of his department.

Seattle Jovian League.

President R. Worth of the Seattle Jovian League and northwest manager of the American Every Ready Company, announces the following committee on program for the weekly luncheons of the league: F. W. Loomis, chairman; F. N. Killam, J. A. Reardon, Guy M. Ward, H. C. Moss. This committee will serve three months.

Portland Jovian Luncheon Club.

Informal luncheons are to be held every Wednesday noon at the Hazelwood, at which the members may order whatever they desire as in future no regular luncheons will be served. This idea should tend to popularize these mid-week gatherings. It is the intention to arrange occasional special events of which the members will be notified. A special room has been placed at the disposal of the Club.

Los Angeles Jovian Electrical League.

B. F. Parsons, general superintendent Southern California Edison Company, was the speaker at the regular luncheon on Wednesday, October 1. Mr. Pearson, who has recently returned from an extensive trip to Europe, gave an exceedingly interesting talk on the conditions prevailing abroad. He brought out the point that although practically every necessary article of living cost as much or more there than on the Coast wages were only about half as large. In spite of this fact he said that the natural thrift of the people enabled them to rear their families respectably. He mentioned the fact that transportation companies were quietly investigating the possible effects of the Panama Canal on the Pacific Coast, and predicted many new settlers to this country in the next few years. The interest occasioned by Mr. Pearson's talk was exceeded only by his own great enthusiasm and confidence in the future of the Pacific Coast. Fifty-eight members and visitors were present. The Electrical League has been combined with the Jovian League under the name given above.

Utah Electric Club.

The weekly meetings of the Utah Electric Club were resumed Thursday, October 2d. Over a hundred members were present at the first luncheon at the Commercial Club on that date. Bayard W. Mendenhall, chairman for October, presided. Chester P. Cahoon was elected chairman for November, and Mr. A. R. Loughborough for December.

Popular local entertainers provided a musical program during the luncheon.

Mr. W. C. Orem, President of the Salt Lake & Utah Railroad Company, described in a most interesting manner the progress of the construction on their interurban line from Salt Lake City to Provo, a distance of forty-seven miles. Since April 1st, when construction on this line was started, the grade throughout the entire distance has been made, practically all of the bridges are completed, and approximately fifteen miles of steel laid. The line will serve fifteen thousand people in Salt Lake County and thirty-five thousand in Utah. Hourly service will be instituted in each direction.

The territory traversed by this line is a very fertile one, irrigation projects now nearing completion plan to double the irrigated area along the route, and with the intensive farming methods which will follow the initiation of interurban service, Mr. Orem has great confidence that the population served will be trebled within a very short time.

Los Angeles Section, A. I. E. E.

The opening meeting of the Los Angeles Section of the American Institute of Electrical Engineers was held at the Union League, September 25, 1913, with forty-two members and visitors present. An informal dinner and reception was given in honor of the visit of Mr. Ralph W. Pope, honorary secretary, and Mr. F. L. Hutchinson, secretary.

George A. Damon as retiring chairman, introduced E. A. Northmore, as chairman for the ensuing year.

Mr. Northmore outlined his policy and appointed the following as chairmen of committees: Carl Johnson, Entertainment Committee; R. H. Manahan, Discussion; J. E. MacDonald, Papers; Geo. A. Riley, Property, and H. B. Lynch, Membership Committee.

J. A. Lighthipe gave an interesting report of the Pacific Coast meeting of the A. I. E. E. at Vancouver, B. C., over which meeting he had the honor to preside. Ralph W. Pope gave a synopsis of the early days of the Institute, and F. L. Hutchinson delivered an address regarding Section matters. He complimented the local Section on their efficient work last year and also on the character of the papers submitted. He further complimented Mr. Lighthipe upon the manner in which he handled the meeting in Vancouver.

Remarks were also made by Max Lowenthal, H. H. Sinclair, O H. Ensign, Jas. W. Warren and Dr. Carhart.

TRADE NOTES.

The municipality of Coquitlam, B C., is now advertising an election on the question of issuing $15,000 for fire protection.

The city of Victoria is calling for tenders on 10,000 ft. of 3 in. fibre conduit. The bids will be received up to October 6, 1913.

J. L. Hamilton and J. Fraser have selected a site for the proposed electric light plant which they will install at Smithers, B. C.

A large dam is to be built and a hydroelectric plant installed on the Big Horn River at Hardin, Mont. Mr. B. C. Lillis is the engineer.

The Pacific States Electric Company, San Francisco, announce the compilation of a new general supply catalogue, which will be ready for distribution January first.

The Seattle branch of Chas C. Moore & Company, engineers, has secured the contract for furnishing two 1100 h.p. water wheels for the Kamloops hydroelectric plant.

The California Glass Insulator Company, Los Angeles, recently shipped to the Western Electric Company 20,000 double top groove glass insulators. This company also recently made their second shipment of insulators to Manila.

The A. G. Electric & Manufacturing Company, Seattle, is designing a complete line of remote control switches for the San Francisco market, having already procured orders for approximately a dozen of these switches of various sizes.

The A. G. Electric & Manufacturing Company, Seattle, has branch offices in the Rialto Building, San Francisco, and will probably build a San Francisco factory at an early date. The company manufactures switchboards, switches, cabinet and panel boxes. A. E. Griswold is in charge of the San Francisco branch.

Incident to the rapid development in the northwest and the consequent growth along construction lines, the Pacific States Electric Company, have found it necessary to take additional quarters in the Elks' Building, Portland, Ore., increasing their floor area 50 per cent. The added space gives the concern a total store frontage of something like 120 ft. on Broadway, the main thoroughfare of the city and is an immense advantage from a sales standpoint in that opportunity is afforded for attractive window display. The new street numbers will be 88-90-92 Broadway.

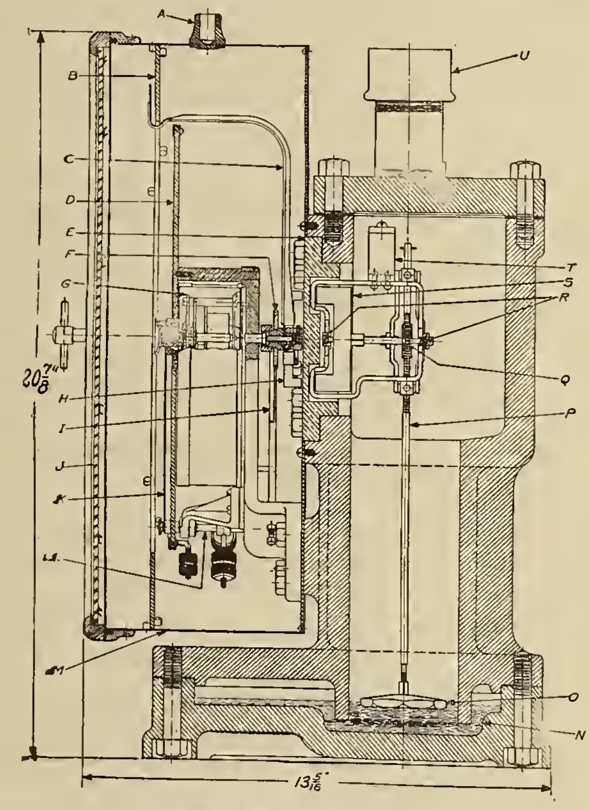
INDUSTRIAL

AN IMPROVED FLOW METER.

The meter shown in the illustration is a strong, mechanical meter, which can be used not only as a test instrument, but as a stationary meter for the continuous measurement of either liquids, gases or vapors.

The body flow of the meter consists of an iron casting cored so as to form one leg of a U-tube, and a reservoir for mercury, the outer leg of the U-tube being formed by a pipe which opens into the reservoir. The pressure on the surface of the mercury varies with the rate of flow of the fluid being measured.

A float, resting on the surface of the column of mercury in the body of the meter rises and falls with the corresponding change in its elevation, and is geared by rack and pinion to a horizontal shaft carrying a permanent U-shaped magnet.



Cross Section of Flow Meter.

A—Boss for attaching bracket lamp. B—Indicating scale plate. C—Indicating needle. D—Plate holding chart. E—Copper plug. F—Pinion.—G Clock. H—U-Magnet. I—Sector. J—Glass in door. K—Recording pen. L—Shaft connecting recording pen to sector. M—Case containing external mechanism. N—Mercury well. O—Float. P—Rack. Q—Pinion engaging rack. R—Bearings. S—U-Magnet. T—Bracket supporting internal mechanism. U—Dome for rack when float is raised.

The poles of this magnet face a copper cap which closes an opening into the meter body. The remaining parts of the meter's mechanism are mounted on the outside of the cap. A shaft, parallel to the one on which the magnet inside the body is mounted, carries a smaller magnet whose poles are opposite those of the larger magnet, this arrangement serving to transmit motion through the cap without piercing it with a shaft, and thus the difficulty of effective packing is avoided. As the poles facing one another are of opposite polarity, the magnetic flux binds them together so that a movement of the magnet inside the body involves a corresponding movement of the one outside, the latter moving the indicating needle and the recording pen.

The pressure which moves the column of mercury in the U-tube is obtained, for pipes two inches and greater in diameter, by inserting a modified form of Pilot Tube termed a "nozzle plug" directly into the pipe line. This can be done without disturbing the piping, except where it is desired to increase the rate of flow at the point of metering, in which case a special pipe reducer is provided. This reducer is made of brass and has a long throat with rounded entrance terminating in a flange. The flange is inserted between the pipe flanges and is held in place in the same manner as a gasket.

The nozzle plug is a tube with two separate conduits in it, each having a set of openings, the leading and trailing, the two sets being on diametrically opposite sides of the tube.

The flow against the leading openings in the nozzle plug sets up a pressure in the leading conduit which equals the static pressure plus a pressure due to the velocity head. The flow past the trailing openings causes a suction which lowers the pressure in the trailing conduit. As these two conduits are connected to the U-tube by ¼ in. pipes, the column of mercury is affected by this unbalanced pressure causing a movement of the float. The leading set of openings in the nozzle plug extends approximately across the pipe diametrically, so as to make the velocity pressure transmitted to the meter the mean velocity pressure rather than that at a single point in the pipe.

The chart on which the pen records are made is rotated by a clock work, the recording pen sweeps the chart radially and the curve shows the rate of flow at any time during the chart cycle.

The intergrating device consists of a stationary flow-rate planimeter wheel. This device is extremely simple and there is practically no danger of its getting out of adjustment.

For pipes less than two inches in diameter, an orifice tube is provided, and it must be incorporated in the pipe line.

To meet the requirement of different classes of service the meter can be made up in four different ways: First, as a recording or curve-drawing instrument; second, with both indicating scale and recording chart; third, with recording chart and integrating dials; fourth, with indicating scale, recording chart, and integrating dials.

With the use of this meter the record of the performance of the apparatus shows whether it is operating at the greatest efficiency or not, and very surprising conditions have been brought to light by their use. A flow meter on each boiler of a battery running in multiple on the same header shows just what each is doing and so permits proper division of the load. From the graphic record of steam pressure it is possible to determine whether the method of firing can be made more efficient or not.

In a big plant the use of flow meters makes it possible to segregate the costs of the steam, water, etc., so that each department can be charged with its share of the costs of these. In office buildings, the steam used in heating each office can be measured and the amount of water used also recorded, thus serving as a check to the waste, while a study of the feed water chart will determine the rate at which the feed water should be supplied to secure the highest degree efficiency.

The flow meter described above is manufactured by the General Electric Company, Schenectady, N. Y.

NEWS NOTES

FINANCIAL.

HARRISON, IDAHO.—At the special election held here the taxpayers voted down the proposed bond issue of $15,000 for the purpose of purchasing the water works and rights of the local water company.

RED BLUFF, CAL.—At a meeting of the city trustees a resolution was adopted instructing the city attorney to make preparations for the calling of a bond election of $85,000 for a municipal water system.

SAN FRANCISCO, CAL.—The Southern California Utilities Company has applied to the commission for authority to issue notes to the amount of $50,000. The company is developing a water project in Riverside County.

VICTORIA, B. C.—An election will be held in the city hall this week to decide if the City of Victoria should issue bonds in the sum of $1,500,000 to be used in acquiring and constructing the Sooke Lake water supply for the City of Victoria.

SAN FRANCISCO, CAL.—The railroad commission has denied the application of the Empire Water Company to issue $100,000 in bonds. The company desired the bonds for the purpose of constructing a submerged dam near Coyotte Creek in San Diego county.

LOS ANGELES, CAL.—The proposition of calling another special election to vote on power bonds will be taken up by the city council. An effort is being made to secure segregation of the bond issue into $1,250,000 for completion of power plant, and $5,250,000 for distributing system.

KELSO, WASH.—Through the transaction closed on Thursday of this week the Washington-Oregon Corporation disposes of the Kelso waterworks to the Independent Electric company. It is announced that there will be no change in the concern, with B. M. Atkins remaining as manager of both interests.

LOGAN, UTAH.—Secretary Morris Swinyard of the Ogden-Logan and Northern Railway Company, has been here from Lewiston the past few days signing up the bonds upon which the company hope to release the $600,000 with which to build the road. The bonds will be negotiated in France, and the one-half of this total amount is payable on October 31st.

ILLUMINATION.

PORT MOODY, B. C.—The B. C. Electric Company has offered to install 30 street lamps for the municipality of Port Moody, B. C.

SEATTLE, WASH.—The Edmonds Electric Light & Power Company has filed an application for an electric lighting franchise in Richmond Beach.

SIDNEY, B. C.—The B. C. Electric Railway has come to an agreement with the civic authorities of Sidney, B. C., for installing a street lighting system.

BAKER CITY, ORE.—The city commissioners have awarded the contract for supplying poles for the municipal power line to William Kirkland, who was the lowest bidder at $3.50 per pole.

SAFFORD, ARIZ.—According to information furnished by the Gila Valley Electric, Gas & Water Company, a contract has been closed for an electric light plant, for Safford to be in full operation by January 1, 1914.

WHEELER, ORE.—The city council granted a franchise to the Wheeler Lumber Company for putting electric lights into the city. The work of installing the pole line is now in progress, and the company will extend to the northern limits of the city at once.

REDDING, CAL.—Dynamiters wrecked the steel pipe line feeding the south power house of the Northern California Power Company on the Tehama County side of Battle Creek, a few days ago. A reward of $1000 has been offered for the arrest of the perpetrators of the act.

SAN FRANCISCO, CAL.—An application to the Supervisors for leave to extend the mains of the Universal Gas & Electric Company has been made. The company contemplates large competitive extensions into both fields, gas and electric, provided the supervisors grant the necessary permits.

CARLTON, ORE.—The city council has granted a 25-year franchise to the Yamhill Electric Company to furnish the city with light and power. The company will supply its current from its plant in Newberg and plans to have the wires strung into this city inside of six weeks. The contract is for a 24-hour service.

NEW WESTMINSTER, B. C.—A preliminary estimate of the value of the Westminster Gas Company's property submitted to the council by consulting engineer Pabst, of Portland, Ore., places the value several thousand dollars above the figure of $150,000, at which price the option price was secured.

PORTLAND, ORE.—The Portland city council has approved the proposition of embodying a hydroelectric engineer for investigating various projects which Commissioner Daly of the public utilities department has under consideration. This is for the purpose of procuring data that may be placed before the voters when the question of establishing a municipal light and power plant comes up for consideration.

SAN FRANCISCO, CAL.—The towns of Marine View, Moss Beach, Farallon and Montara have formed a lighting district for the maintenance of street lights. The improvement organizations are co-operating with the districts of Granada, Princeton, Miramir and Halfmoon Bay, along the line of the Ocean Shore road to form a similar lighting district, which will practically connect the more important towns with continuous lighting for a distance of 20 miles.

LOS ANGELES, CAL.—Sealed bids will be received up to October 20th, by the Board of Supervisors of Los Angeles county for installing and maintaining an addition to the system of street lighting in Van Nuys Lighting District, in accordance with specifications and plans. The lighting system will include the erection and furnishing of ornamental lighting posts, complete installation of conduits, wiring, connections, lamp posts and globes and furnishing electric energy for a period of 5 years.

SAN FRANCISCO, CAL.—Permission has been granted to the Pacific Gas & Electric Company to install, at its own expense, a chain of experimental electroliers in Fell street along the north side of the Park Panhandle, between Baker and Stanyan streets, a distance of eight blocks. It is claimed the new light is superior to any in use for street illumination, and the company has promised to run the lights for three months at no cost to the city, and to remove without expense to the city if the light is not satisfactory.

OGDEN, UTAH.—A feature of the Fashion Show spectacle at Ogden last week was an immense searchlight installed by the Utah Light & Railway Company on top of the Eccles Building. This searchlight is one of the battery used by the Utah Copper Company in illuminating the side of the mountain at Bingham for it's steam shovel operations. Frequent comment was made during the fashion show that while the searchlight helped somewhat, it was not absolutely necessary with some of the styles in vogue this season.

TACOMA, WASH.—Although sanctioned by the city attorney the validity of the council's action in diverting $44,000 of the light plant's profits to the general fund is being seriously questioned by the light consumers. To assist in obtaining a low tax levy the council reduced the lighting rate to the various departments just one-half, which deducted from the profits of the light plant $44,000. Whether the plant's bondholders will object to this procedure is an unsettled question. Before the diversion was made the plant showed a profit of $113,000 for the year.

TACOMA, WASH.—A. L. Thorn, commercial manager of the municipal light plant, has filed a report on the new business obtained since January 1st. The commercial department, which solicits new business for the plant, has been in existence since March, 1913, only. It is shown that a total of 2,085 h.p. has been contracted for in power business alone, not considering the cooking ranges and electrical apparatus installed in the homes which are bought through local dealers. Despite the high initial cost of cooking ranges more than 100 have been installed in recent months. The city gives a rate of 1 cent per kw.-hr. for cooking. Full-page advertisements are employed in the newspapers telling of the advantages of cooking by electricity

WENATCHEE, WASH.—The Central Washington Gas Company has formally accepted its new plant. The contract time for completion was November 1st, but urged by the gas company who wished to give service as early as possible, the contractors, Cruse-Kemper Company, Ambler, Penna., imbued, by contact with the spirit of the West, completed their work so very much ahead of time. For years past there has been a demand for gas in Wenatchee as other fuel costs are high. As an incentive to consumers to connect up with the new service, the company is giving free gas to November first. All the machinery in the plant is electrically driven. The officers of the company are: President, Arthur Gunn; Vice-President, J. H. Stout; Second Vice-President, Geo. D. Brown; Secretary, Fred M. Crollard; Treasurer, R. O. Kennedy.

TELEPHONE AND TELEGRAPH.

BEND, ORE.—W. F. King, Pioneer Telephone Company, Prineville, states that directors have ordered the installation of a common battery system here.

SANDY, ORE.—Both the Multnomah & Clackamas Mutual Telephone Company and the Firwood-Dover Telephone Company, are endeavoring to secure a 25-year franchise.

GLENDIVE, MONT.—It has been ordered that the pioneer Telephone Company be granted permission to construct its telephone lines between the city of Glendive, Circle and Jordan, along the public highways between said points.

SAN FRANCISCO, CAL.—The Reedley Telephone Company has applied to the California Railroad Commission for authority to issue 2500 shares of its capital stock at the par value of $1 per share to provide for extensions within the city of Reedley.

SAN FRANCISCO, CAL.—Years ago the supervisors fixed a license fee of $251 per quarter on the Pacific Telephone & Telegraph Company. The company resisted in a suit and the Supreme Court has decided that the local tax is unconstitutional.

PALOUSE, WASH.—A franchise has been granted the Inland Independent Telephone Company to string wires through certain streets in this city in building their line from Spokane to Lewiston, but the company is not to operate an exchange here or long distance station.

FLAGSTAFF, ARIZ.—The Indian department has secured an appropriation for a telephone line from Tuba to Flagstaff, and is now securing telephone poles of the Forest Service ou the National Forest, getting ready to put the line up this winter. The new line will be about 90 miles long.

SAN FRANCISCO, CAL.—The Pacific Telephone Herald Company has filed complaint of discrimination with the commission against the Pacific Telephone & Telegraph Company in which the Telephone Herald Company asks the commission to require the defendant telephone company to furnish wires as applied for.

REGINA, SASK.—The government telephone system of the province of Saskatchewan, Canada, expended $1,526,755 during the year ending February 28. 1913. The gross income amounted to $392,393. During the year construction was done as follows: New toll offices, 46; new exchanges, 34; pole miles, long distance, 516.22; wire miles, long distance, 3,766.8; and service was extended to 4,288 new subscribers during the year, making a total of 9,850 subscribers now being served. In addition to the government system there are, in Saskatchewan, 251 rural telephone companies, 22 independent companies and five municipal telephone systems.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company has applied to the state railroad commission for permission to issue $3,000,000 of its first mortgage and collateral trust 5 per cent 30-year bonds. The company proposes to use approximately $1,850,000 of the bond issue for retiring a like amount of underlying bonds of the Sunset Telephone & Telegraph Company. The balance of the amount is to be devoted to improvements of the company's system, including additional switchboard, line and conduit facilities in Los Angeles, San Francisco and Oakland and elsewhere. The improvements also provides for new cable and telephone installations.

TRANSMISSION.

BELLINGHAM, WASH.—Further indications that the Puget Sound Traction, Light & Power Company, intend to begin the construction of a power house on the Baker and Skagit River sites, came to light this week when Henry W. Graut, an engineer for the company, filed papers appropriating water rights in the Baker River. Both of these sites were in the hands of the Skagit Power Company, but this company was absorbed by the Puget Sound Traction, Light & Power Company.

TACOMA, WASH.—The council is considering the proposal to do away with all municipal direct current business. The Nisqually plant develops alternating current and the city has not installed a converter. The two lift bridges and the city hall elevator are operated by d.c. motors which, are supplied with power purchased from the Stone & Webster interests. The city pays about $5000 a year to the company for power and the cost of changing the motors on the bridges and on the elevator is being considered.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company announces the practical completion to the 215-foot level of the monolithic concrete dam in the canyon of the South Yuba River below Lake Spaulding, in Nevada county. This dam when completed will be the largest in the world, 305 ft. in height, and will impound the waters of the South Yuba flowing into Lake Spaulding, with the result that the lake will be transformed into a storage reservoir of nearly 100,000 acre-feet capacity. This water will be used not only for irrigation throughout the counties of Nevada and Placer, but also for power purposes to the extent of adding something like 190,000 h.p. of electric energy to the Pacific Gas & Electric Company's equipment. Up to August 31 the expenditure on this project totaled $5,160,000, and it is estimated that by the close of this year the investment will have reached $6,600,000. The heaviest expense, however, has already been met, for by the expenditure next year of about $1,250,000 the company will be able to double its output of electric energy from 33,333 to 66,666 h.p. When that is done other developments reaching from Bear River to the Auburn ravine will be considered.

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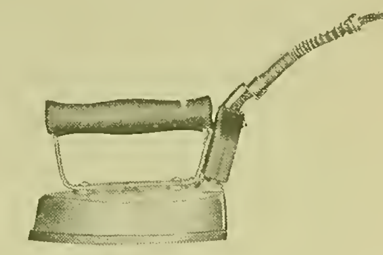

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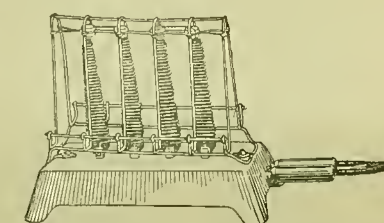

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JOURNAL OF ELECTRICITY
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VOLUME XXXI SAN FRANCISCO, OCTOBER 18, 1913 NUMBER 16

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RURALIZING ELECTRICITY—THE TIRELESS FARMER

BY JAMES E. DAVIDSON.

[This paper, presented before the N. W. Electric Light & Power Association Convention, September, 1913, deals principally with conditions in rural districts in northwestern states, but the article is of general interest in that methods to be followed in securing this class of business are clearly stated and attention is also directed toward the necessity for the intensive cultivation of this new field if satisfied and profitable customers are to result.—The Editor.]

This paper deals with the more important uses of electricity in rural districts, in the order that they should be taken up by a central station manager from the time first thought is given to the subject, assuming that it has been decided to work for business in rural districts and to follow it to a point where an earning is assured.

The geographical scope of the paper will touch on conditions in Washington, Oregon and Idaho.

If transmission and distribution lines are erected on a large scale, returns should not be expected within five years, and a return of a clean 10 per cent, which this kind of pioneering and full-of-chance business deserves, within, say, eight or ten years.

Choose first the most inviting market, if possible along transmission lines where wires can be strung without pole cost. Carefully determine what light and power business is available. The majority of

An Electrically Operated Farm. The Cows Have Been Milked Electrically for More than a year.

The First Consideration.

The introduction of electricity in rural communities is a pioneering subject. It must be dealt with on equally as broad principles as the lighting and power business was dealt with two—and as long as three—decades ago. Whether or not this business is handled on a small or large scale, the future must be discounted in most instances; only in a few cases will the undertaking be profitable at the outset. If extensions are made on a comparatively small scale on a business basis which considers the relationship of all investments and operating expenses, down to actual revenue, and above all with excellent service rendered in every sense of the word, some return should be realized at the end of the third year.

farmers will sign contracts at the start, but the remaining will sign up only when the line is built and in operation. You may be discouraged in the early stages of the venture as the net earning possibilities will appear to be slim, but hard work, wisdom and patience on the part of you and your organization will bring results. You must create a load that will "bring home the bacon" by displacing horse, manual and gasoline power with electric power, and then show the farmer that some real, new money lies waiting for him if he adopts some of the scientific methods that you will show him.

The farmer will have to be educated in the practical use of electricity, and your company must be the "bureau of education." This means that you will have

to study local rainfall records, climatic conditions, all about the different kinds of soil, what is best to raise, the cultivation of fruit, alfalfa, garden truck, grains, the raising of cattle, sheep and hogs and the best and most economical manner of handling these commodities. Study the preparation of different products for the market in order to get the highest selling price and go particularly into the most profitable sales methods. Most of us have created many ideas in building up our business from the "creeping" stage so that suggestions can often be made to the farmer that will make him our life-long friend. Be conscientious and by no means encourage anything that is not best for the farmer. Prepare yourself with an abundance of practical knowledge and go easy in building new lines until you have an opportunity to become familiar with the many new conditions.

Nowadays, all of us realize that, in order to interest a merchant in a modern lighting system, a manufacturing concern in changing from steam to electric power, or the housewife in using an electric range instead of a coal or wood range, in the first instance practical illuminating engineering must be used to convince; the manufacturing plant cannot be connected to our lines until the whole plant is studied and tested and the manager shown a saving in dollars and cents, and practicability, durability, convenience and reduction in cost must be proved to the average range user to have her buy it. In the farmer's case, we must adopt even broader gauged principles. Several different kinds of demonstration plants must be connected up to prove your case. Watch and test each, as from these you can gather an abundance of helpful data which is your stock in trade.

Present and Prospective Business Possibilities.

Naturally, the lighting business will be the first and easiest to obtain. Sometimes the farmer can be interested at the start in a pumping outfit for domestic and stock purposes, which also can be used for fire protection. The Kewanee system is well thought of for this kind of service. The farmer can also be interested in utility motors, operating through shafts and belts for grinding alfalfa and other feed, operating cream separators, sawing wood, churning, turning grindstones, etc.

The mention of any particular make of machinery or appliance does not imply that this association or the writer recommends or guarantees such machinery or apparatus, but simply that it has been tried on the lines of the Pacific Power & Light Company and is apparently in successful operation. There are other makes that are just as good as those mentioned.

It is a well known fact that by grinding, or cutting alfalfa, its nutritive powers are greatly enhanced. It would be well for those interested to look this subject up thoroughly.

Many farmers realize that the electric incubator is a God-send. Fowls make money for the farmer, who spends it in town where we do business, and the business man spends his money with us at his place of business and home, so we produce here, as in every other instance, for everybody, both going and coming. The "Spokane Electric" and "Reed Self Regulating" incubators are the makes generally used in our territory. These types cost about $15 for the 60-egg size and $25 for one of double that capacity. Electric incubators hatch on an average of 90 eggs out of 120, while John D. Rockefeller's type only produces 67 to 70 chicks from the same number of eggs. Around Dayton and Walla Walla, Washington, many electrically heated incubators are used. This is fine business as it is a 24-hour load, running throughout the hatching period of 23 days. The more incubators used and the more hatchings from them, the greater the yearly load factor, and it is more than an entering wedge for other uses of electricity.

"Enterprise" Fruit Wiping Machine.

Like many other classes of farm machinery, the "apple wiper" uses power only a few months in the year, but builds up the load factor of the utility motor.

Electrically Driven Apple Wiping Machine.

The machines are made in Zillah, Washington, by the Enterprise Fruit Wiping Machine Co., and require one horsepower for their operation. Even though they have been on the market but two years, large numbers are being sold. With three men, 600 boxes, or one car of apples, can be wiped in one day. This machine, in other words, will save in labor the wages of seven men a day, which, at $2 a day per man, means a daily saving of $14. This big saving is secured with no damage to the fruit. One solicitor placed thirteen of these apple wipers in a month.

The cows of the Valley View Dairy Farm, Granger, Washington, are milked with a Sharples milking machine, operated by a two horsepower motor and vacuum pumping equipment. Because of the rapidly increasing population of the United States and a proportionate decrease in the number of cattle raised on account of the fact that the large ranches and other land holdings are being cut up into small tracts for intensive farming and mixed stock raising, dairying is becoming very profitable, and this business is now beginning to be conducted on a very high plane of efficiency. Probably the best incentive for real businessmen to take up this industry in the last few years is the perfecting of the mechanical milker and, now that the central stations are reaching far out into formerly isolated rural communities with their transmission lines, another strong impetus has been given this business as cheaper power for the operation of these machines can be had. From the dairyman's side of the question, he saves in labor as compared with hand milking approximately $1 per month per cow milked. Roughly, one man can, with a four-unit milking machine, milk four times as many cows as he can by hand in the same length of time.

From the central station's side of the question, you obtain a load that is guaranteed for every day in the year, and the early morning load is of especial benefit. Estimating again, every cow milked by the machine earns for the company $1.75 per year, figuring that one four-unit machine will handle a herd of 28 cows. When a salesman is endeavoring to sell an appliance, the ultimate point in view being to increase the consumption of electricity, the labor saving features of the

Milking Cows by Mechanical Means.

electricity itself are good things to be mentioned, of course, but when telling of the good points of the mechanical milker, if he mentions the fact that 75 per cent of the expense of milking is given back to the dairyman in net profits, the output of milk is cleaner and better because of the decreased number of bacteria, and the night-mare of always trying to find a reliable, cleanly, gentle and efficient man who will stay right on the job twice a day, 365 days in the year, who has a disposition so patient that he will sit quietly and gently milk a cow while she slaps her tail around his neck and places her foot in the bucket, or who will coolly sit down beside a hot cow and milk her in fly time with the thermometer 100 degrees in the shade, will be eliminated, a sale can be made eight times out of ten. The point is, don't talk technicalities; talk "sense with cents."

The electric range now, and particularly in the future, will be an inviting addition to the farmer's kitchen, because of its advantages in low cost of operation compared with high cost of fuel in most rural localities, lack of availability of gas and the many advantages known to all of you that are afforded the housewife who generally does her own work. Consequently negotiations for its installation should be started at the inception of electricity on the farm. About the only obstacle in the sale of electric ranges is the difficulty of furnishing heat economically for the hot water boiler. This can be overcome by using small coke or coal heaters that can be purchased at about $9, or a small, common heating stove may be used for this purpose. The Pacific Power & Light Company is using quite extensively the Vulcan coke heater. This heater serves its primary purpose, and in cool weather helps heat the kitchen while, in remote cases where there is an interruption to service at meal time, small quantities of food can be cooked on the auxiliary. In less than a year, we have placed in successful operation approximately 50 ranges. The Copeman type is generally sold. We find for the average sized families that the monthly cost is $2.91, with a charge of five cents per kilowatt hour and a monthly minimum of $1.50.

Washing machines, to the tune of 350, have been sold, mostly in the past year. Ninety-five of these are in and about Pomeroy, Washington. This town has a population of 1700 and we have connected 369 customers. These figures show that 25 per cent of the housewives in this community do their washing with electrically operated washing machines. In the district at Sunnyside, Washington, there are 68 of these machines in operation.

Refrigerating plants can now be purchased at such reasonable prices that a market is staring us in the face. The farmer will be quick to see the low installation cost compared with cost in natural ice belts, of installation, operation, etc., of the old-fashioned ice house. Mr. Osborne, of the Washington Water Power Company of Spokane, in his unusual activities in farm districts, is meeting with flattering results in disposing of three to six horsepower Armstrong refrigerating plants, which are made in Spokane.

Household appliances are sold much easier in the country than in the city, particularly flat irons, toasters, washing machines, etc., because of their practicability and labor-saving features, which are quickly seen by the farmer's wife, and in the case of the iron and washing machine they are especially apparent because of lack of competition of the city condition where laundries and foreigners do washing and ironing. Efforts to sell other appliances should be made the same as in the city.

The proposed line may run near a few country stores, which will always contract for lights. A mill, even when operated by hydraulic power, can be at least interested in buying power when the stream flowage is low, and in many instances at all times; especially if its equipment is badly depreciated.

School commissions can be interested to co-operate in the installation of experimental tracts for agricultural purposes, for which water is lifted by a motor-driven pump, and also in the use of heating and cooking devices in the domestic science departments of public schools. In lending help to such undertakings, education is afforded that is directly valuable to the power company and, of course, to the community. Schoolhouses with ventilating fans make good customers, and an earning can also be derived by lighting these buildings.

Railroad depots will take lights, and many times motors displace engines for water tank filling and coal elevators. Small hamlets need water. Induce them to install a plant for domestic water, which is pumped from a well. The Pacific Power & Light Company had connected this year 595 horsepower, earning about $9500 per year, in county rock crushing plants. Near Pendleton, we have two portable transformer banks that are moved along the highway, furnishing power for two crushing plants that will operate for two or three years. The county commissioners of Columbia

county, Washington, have contracted for county road-building use a few miles outside of Dayton for an electrically driven air compressor to run three-inch rock drills, besides 30 horsepower for crushing plants. In other parts of Washington, the State Highway Commission operates two crushing plants. The road-building plants afford very good business, as they operate six or seven months in the year, but entirely off lighting peaks of the summer or winter.

To most of us, the power load derived from irrigation is the nucleus of rural business.

Electrically driven pumps afford loads from a few horsepower to several hundred, which in the arid country east of the Cascades are on the distributing lines many hours each day and for the irrigation season of five or six months, being entirely off our winter peak.

To successfully exploit the use of electricity in this truly unusual power field, education is more essential than in any other branch of the power business. In most cases, the source of water supply is from wells, water being circulated from a very few feet to two hundred and more. Many times water is taken directly from an open source. The centrifugal type of pump is most commonly used. Like the presumably simple water wheel, it is the most deceiving piece of machinery made. Never assume that this docile creature can operate on any other than the specifications of head, including friction losses in pipe, quantity of water handled, speed, etc., etc., for which it is made. If you do, you invite trouble for your customers and no end of it for yourself.

As I can no more than point my finger at this great big subject because of lack of time and space, I warn you to gather all the data under which the pump is to be operated in the same careful manner you would for any piece of machinery that is to operate in your plant for the coming 20 years. The purchaser should insist on "wire to water" efficiencies that are reasonably high. If the actual efficiency, say, of a 500 gal. pump is 25 per cent, and it should be 50 per cent, the current consumption is 100 per cent too high, which means a prohibitive motor overload and high power bill. Even though rainfall is heavy, irrigation is profitable for all crops generally raised in the northwest. Eighty per cent of all irrigators will discard gasoline engines and frequently other systems of irrigation, and install motors, providing you can convince them of an actual saving in power cost and also point out the many advantages of the electric drive.

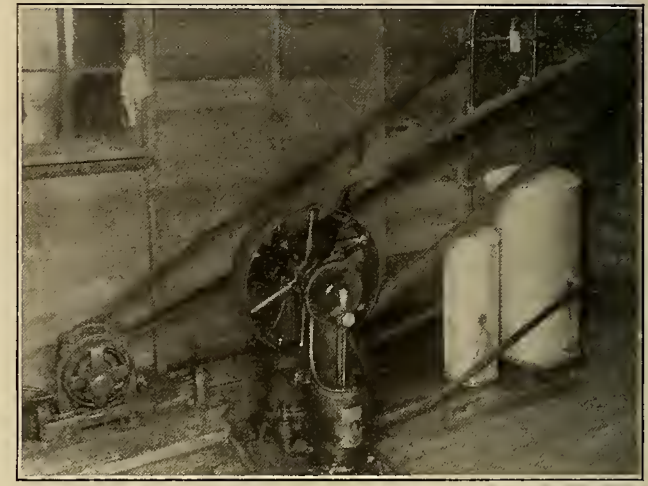
Anyone who has traveled over even small portions of our three northwestern states knows of the hundreds of thousands of acres of land that, if watered, will raise anything that grows out of doors.

This is the answer to the query about the field of irrigation power.

Undoubtedly this subject will be treated within the discussions, but before dropping it I desire to call your attention to a wonderful yet not unusual growth from raw sagebrush land to a beautiful orchard in a period of 42 months, the water having been pumped electrically at Sunnyside, Wash.

Style, and certainly the figures in a rate, are guided entirely by local conditions. Many who have dwelt upon this phase of our rural business advocate, as a type, the common flat kilowatt hour rate, because of its simplicity. True enough, simplicity should be the watchword, but the style of rate referred to is discriminatory, and, therefore, not equitable or lawful because in the case of high load factor the customer is overcharged and under opposite load conditions, the company's return is likely to be inadequate.

Fundamentally, we must be amply compensated for fixed charges, and as the farmers will give us a low annual load factor it is best to have a fixed or ready-to-serve charge. You may find that your rural power business dovetails with your annual load demands, thus helping your diversity factor. If so, you can make this fixed portion of your rate only high enough to care for the fixed expense. This can be based on maximum demand, or connected load in horsepower, kilowatts, or kilovolt amperes. Personally, I believe in connected horsepower up to a given number of horsepower—not over 25—and for the use of maximum demand in kilovolt amperes on larger



Electrically Driven Vacuum Pump for Mechanical Milker.

installations. This fixed charge has the greatest advantage because it automatically takes care of the load factor to a large degree. This is necessary because of the different types of loads and the various ways electricity is used on the farm, especially if power is used for irrigation pumping. Besides the fixed charge, the kilowatt hours consumed should be billed at a low rate, scaled down, say, in five or ten steps, based on the hours' use per day of the connected load, or the maximum demand.

A farmer can actually only afford to pay so much per acre-year for land watered in the case of irrigation, per ton or per pound for products for electricity consumed, so it behooves your power seller to produce your juice, transmit and distribute it, and be satisfied with such a reasonable profit that will effect for the farmer a saving overall kinds of animal or other mechanical power.

Flat rates have advantages to the company because of the assurance of a flat income, saving in meter investment reading same, clerical expense, avoidance of many complaints, etc. The customer likes such a rate because it deals with dollars and cents only, is uniform and the amount of bill is known

in advance; but its real popularity comes because there are no very limited restrictions on maximum demand or kilowatt hours.

Lighting.

Probably in 90 per cent of the cases, lighting rates must at least be similar in style to those the corporation charges in nearby cities or towns. Usually a higher kilowatt hour charge should be made with an increase in the monthly minimum of 25 per cent or 50 per cent.

Heating.

For heating, I suggest a rate on the flat kilowatt hour basis, with a minimum monthly charge for each range installed. The range can be on a range meter or on the regular lighting meter, which must have sufficient capacity to care for this load.

Contracts.

Because of the investment involved, I urge for the best interest of the power company and the farmer that a carefully prepared contract be entered into for all kinds of service to be rendered, particularly in the matter of power.

a. Rates.

b. Minimum charges. Payment of bills and discounts.

c. Duration, which should not be less than five and preferably ten years.

d. Specifications as to current to be furnished, such as voltage, phase, cycles, etc.

e. Power company reserves right to require customer to stay off peak, three or four hours each day, especially in the case of pumping machinery above five horsepower. And that the company assumes no responsibility for crop failures where power is furnished for irrigation pumping.

f. Lien on land for protection of power bills. This is required by our government in collection of its maintenance charges.

g. Right-of-way over customer's property.

Above all, avoid as far as possible using technical terms. Talk dollars and cents and be very conservative in your figures, whether engineering or financial.

Soliciting.

Without doubt, it is within the power of the solicitor to make a failure or success of the rural district undertaking. Even if he should have a thorough knowledge of each of the many uses of electricity in this new field, the business-getter must have a personality that will take with those who make their living from Mother Earth; also be possessed with diplomacy 99 per cent fine. Most folks want something they cannot have. So take advantage of this trait in psychology and insist that the lines will not be constructed until the necessary amount of business is contracted.

Soliciting in outlying districts is necessarily expensive because of the high-grade assistants required, cost of livery and auto hire, living expense when the representative is away from home, and the time and patience required in negotiating with the farmer. In this same connection, much expense can be avoided if the representative of farm and pump machinery concerns, and in some instances those selling motors and other electrical machinery, can travel together, but great care must be exercised in that the purchaser understands that the power company is in no way responsible for machinery it does not sell. I believe the power company should not sell apparatus other than electrical. In fact, that policy seems to prevail with most companies now in the rural district field. Local conditions, though, may alter such a policy. The central station must become interested in determining proper machinery and its installation. This will require much study, especially in connection with pumping machinery. "By-guess-and-by-God" methods tend to cause failure to your farm undertakings. Much valuable information is set up in data books of motor builders, pump companies, etc., all of which must be studied and referred to by those endeavoring to interest the farmer in using electricity.

As a guide in exploiting this kind of business, I suggest that the cost of installing distributing lines, transformers and meters be equal to only twice the amount of estimated annual earnings from contracted business, and certainly that the ratio of earning to this construction cost be greater than 3 to 1, or for every hundred dollars spent, there should be a gross earning of, say, thirty-five dollars per annum.

Line Construction.

Both transmission and distribution systems must be constructed at the lowest possible cost, but high enough to avoid too large a maintenance and depreciation charge. Already established transmission lines play a big part in keeping down investment for such new construction, as they can be tapped by out-of-door type transformers, or, if need be, connected to indoor type transforming apparatus. Furthermore, the transmission poles can be advantageously used for distributing circuits. When new lines are to be set up, where possible advantage should be taken of the economy effected by the farmers' co-operating with you in furnishing teams and labor in drawing material, digging holes, etc. Many times, they will furnish cedar poles cut from nearby woods. While it is not advisable to use too short poles and those having tops and other cross-section dimensions below our standards, shorter timber than would be used for similar service in city limits can be set. Long spans greatly cut down pole, erection and equipment costs. Two-hundred foot spacing is permissible if due regard is given to pole strength, wire sagging, guying, etc. As 6600 volts, and sometimes 12,000 volts, are used for distribution, iron and copper-clad wire can be put up with great economy. It is advisable to use copper-clad wire for long spans because of its tensile strength. If the former is used, the future load possibilities must be carefully analyzed to avoid the expense of taking down this wire and putting in its stead copper for increased capacity. Main, and a great many times branch, single-phase distributing lines will satisfactorily serve rural community. Such a system brings a pronounced reduction in line and transformer investment. It is well to construct lines with the view of changing to three-phase should demands increase beyond expectation.

Capital for building lines into a territory lacking revenue producing powers is sometimes furnished by the state, county or town, or the individuals who propose using electricity. This money can be paid by returning monthly 25 per cent of the revenue derived from this line. (a)

Note—(a) You are referred to the Technical Section paper read at the Chicago convention this year, entitled "Switching Apparatus for Rural Installations."

Operating Policies.

Service in every sense of the word spells success or failure of your business dealing with the farmer. Keeping current on the lines at all times is essential especially if the motor is a part of an irrigation pumping plant, because in dry weather acres of products can be ruined by lack of water. Furthermore the farmer necessarily handles perishable goods and, if power is used in preparing it for the market, it must be as reliable as in the case of a factory having a big payroll. Voltage tests must be made regularly, particularly where long secondaries are run. The frequency must be kept constant for in the operation of pumping machinery speed characteristics affect the pumping results by supplying too much or too little water.

Each plant must be visited frequently in order to keep all machinery running properly, the farmer instructed in its care, economical operation, etc. A record should be made at the time of each call to ascertain the cardinal features, dealing with operating methods on the farm that directly or otherwise affect results, the farmer's costs as far as they can be obtained and results from sale of products grown. This, and all other data gathered, should be studied, one form compared with another and statistics prepared with a view of helping the farmer get better results, and your own education, as well as getting new business. The national and state governments, universities and our associations are continually getting out valuable information for the farmer. Gather this data for the mutual benefit of the farmer and the employes of your concern. Interest the farmer in keeping records and boiling them down to unit costs. To determine efficiencies and capacities of all kinds of farm machinery, make complete tests with indicating and recording meters when requested, and of your own volition. In reading meters, following up troubles and making repairs, the farmer should have every consideration in the way of dispatch, courtesy and patience that is given the city customer, even though it does cost considerble money for the first few years of operation. Bear in mind that you are establishing principles for a new business in a new community, so I urge that collection principles be laid down at the outset that are businesslike and that they be lived up to. If the charges are just and reasonable, there should be no reason why bills should not be paid. If they are not, it means an expense that must be unjustly paid by the "prompt payers." If any company is financially able to carry the farmer along during his development period, it of course will result in getting much load that would be slow in coming on the lines otherwise.

This new field for power, light and heating loads, will produce directly:

1. Increased earning per capita.
2. Improvement in load and diversity of production and transmission, and distribution machinery and apparatus.
3. Higher efficiency in operating force.
4. A greater net revenue per kilowatt of station capacity.
5. Last and best, a higher net divisible earning.

Indirectly, rural activity produces what Geo. Arrowsmith terms a "community factor," meaning briefly that, for all that our industry creates in outlying districts, feeds to the towns and cities we now serve, a revenue part of which accrues to us from the bigger and better city we have materially aided in building.

Prepare for the new era of the electric light and power industry which has unparalleled possibilities for the whole territory you now and will serve, and to your company great and unthought of results.

We owe a service to the northwest, and mankind in general, to operate the empire that Hill and Harriman worked so hard to build up.

MUNICIPAL OWNERSHIP.

BY R. B. MATEER.

[The author gives a concise account of some of the reasons leading up to municipal ownership, which he describes as "a protest to the abuse of public confidence."—The Editor.]

With municipal ownership of all public utilities, water, light, railway and power not now a spectre, and each year becoming more of a reality, by reason of public demand, it is only fair that the owners of all quasi public conveniences give some attention to the causes of such a sentiment as is voiced in the adoption by ballot of laws obligating a community to the payment of principal and interest on such funds as are used either to parallel existing systems or to purchase the property real and apparent of such utilities as are now protected by franchise rights. The first implies the wanton waste of capital, the second generally results in the acquisition of a "gold brick," a property covered with mortgages secured only by inefficient machinery and rather ancient distribution systems of the patchwork variety; excepting, however, those utilities that are the result of an honest effort on the part of aggressive private capital to break the shackles of a combination—a one man power, exercised generally to the detriment of the consumer and the enrichment of his own purse. A few of the most flagrant reasons for municipal ownership are here stated:

Consolidation. Competitive companies to supply necessities such as power, light and water, or transportation, for territories inadequately served, are formed. Generating machinery is purchased, distribution systems are erected, equipment only of the modern type is placed in operation. Under an aggressive and efficient management, not only the interest and fixed charges are earned, but a surplus is acquired—"Service" is the keynote. The increased earnings are the result of reasonable charges for service meriting the co-operation of the consuming public. Under such conditions, "Ownership by a City" ceases to be a slogan for political advancement. Rate regulation by council or commission is sufficient, until the financial interest of one corporation acquires the control of its competitor, effecting a gigantic consolidation which implies not only the re-financing sufficient to cover existing securities, but the absorption of all the surplus. Such a consolidation places upon the ultimate consumer added burden. As it is the public who must pay the bill, is it surprising that the acquirement of all utilities by a municipality becomes again a burning issue?

Excessive Charges. Consider, if you please, the development of a territory from a desert to a tropical garden possible by the use of such conveniences as transportation, electricity for light, fuel and power purposes. Such necessities may be had, but those interested in the reclamation of desert land must pay the price. The ultimatum is, advance the most of construction, guar-

antee a satisfactory interest on the investment, and service is available. Is it remarkable that other sources of fuel are sought, that isolated generating equipment is ordered, that communities install and operate apparatus necessary to supply the service refused by private corporation? Such a policy is but a boost for municipal ownership.

Manipulation. Again, if you please, consider the message flashed over the wires by the manipulator of quasi public utilities to the patient, conscientious operator of the local light and power company interested only in good service: "Shut down on all extension work. Reduce your operating expenses to a minimum. Conserve all resources." Such a communication is received with dismay; its enforcement is far-reaching. Fear grips the public. Small sums, the reward of honest labor, are withdrawn from circulation and locked in vaults, handicapping business and throttling legitimate investment. Money is spoken of as "tight." The excuse is at hand for high interest rates; values fall. Securities at a low figure are snatched up by the manipulator. Unearned profits are tucked away and the cause for unrest is accomplished. The panic, the implement used by those out for pecuniary gains, is not forgotten; those who have suffered seek refuge in a plea for the municipal ownership of all utilities, as a curb over those whose dominition of public conveniences and greed for wealth inspires financial unrest.

Promotion Piracy. Last, but not least of the contributing causes for municipal ownership, is the greed of the banker who finances competitive light and power companies, not from a desire to benefit the consumer, but solely to benefit his own pocket. Instances of such policies and their success are not rare. They are worked each year. Equipment is installed, the long hour, profitable business of the established company is sought, by offering "bargain rates" and long term contracts, hoping that the curtailment of revenue will force a remunerative offer. Piracy is an appropriate name for the means used to accomplish their purpose. The effect of such promotion is far-reaching, in that it educates the public to a false minimum value of such conveniences as are retailed by public utilities.

Muncipal ownership is but a protest to the abuse of public confidence by those whose training and affiliations should benefit not destroy. Eliminate the promoter, the manipulator, the wrecker and the greedy financier from the control of quasi public utilities, placing their operation in the hands of an honest management, and good service, at a minimum of cost, is guaranteed to a community. Protection on his investment is assured to the stockholder and co-operation accorded the capitalist in financing legitimate propositions.

Long distance runs by electrics are of more and more frequent occurrence. This should serve to check the tendency to aver that the electric is good only for short hauls. A regular stock car was driven from Boston to Springfield and from Springfield to Holyoke and return, a total distance of 114.7 miles on one charge of the battery. The car was equipped with 54 A-6 Edison cells, having a rated capacity of 225 amp. hr. The trip is still more notable as several very difficult hills had to be negotiated. The round-trip between Washington and Baltimore is 82 miles, and this trip, over very bad roads, was made by an electric truck carrying a load of 1200 pounds. With the recent remarkable improvement in battery construction there is no reason why these performances should not be excelled and the electric soon find a much larger field than it at present holds.

THE PERMANENCY OF UNDERGROUND WATER SUPPLIES WITH INCREASED PUMPING.

BY CHARLES H. LEE.

[The determination of the permanency of underground water supplies is of great importance as the interests at stake are too large to wait for the supply to fail, instead of conserving because of accurate knowledge, especially in view of the fact that to readily secure such information is quite practicable and at reasonable cost. Mr. Charles H. Lee is a civil and hydraulic engineer with offices at 934 Union Oil Bldg., Los Angeles, Cal.—The Editor.]

That the underground water supplies are limited is a fact which experience and scientific investigation has established beyond a doubt. The unlimited extension of pumping observed throughout California today therefore cannot necessarily be considered as permanent. In fact, in some districts the future will see the abandonment of many pumping plants now in operation.

In view of these facts is it not good business for large commercial enterprises to know the permanency of subterranean water supplies, upon which they depend for profit? Take, for instance, the hydroelectric project developing a pumping load. Is it not as wise a business precaution to know how much ground water there is annually to be handled in a given district as it is to know the amount of water that can be depended upon at the water-wheels? No modern hydroelectric development is undertaken without thorough preliminary investigation of the stream flow. But what business manager actively engaged in building up a pumping load can say when he has gone far enough? Is is not a short-sighted policy which would invest capital and build up business without first knowing what are the physical limits of that business?

Suggestions of this kind are usually dismissed without ceremony on the ground of impracticability. It is commonly held that the only way to test out underground water supplies is to develop them until they fail. The time has now arrived, however, when the interests at stake are becoming too great to proceed blindly. Fortunately the necessity of proceeding without definite knowledge no longer exists. Scientific investigation of recent years has shown conclusively not only that rate of supply of underground water can be accurately measured, but that this measurement can be accomplished with reasonable cost. The argument of impracticability can therefore no longer be advanced.

The United States Geological Survey has been the most active agency in this work of gathering and correlating underground water data. As early as 1900, the great importance of such information was recognized by Mr. J. B. Lippincott, then resident hydrographer for the Survey in this State. Under his direction water plane measurements were made in several important ground water districts, and preliminary plans were formed for broad extension of such work. The final development and execution of these plans was accomplished by Mr. W. C. Mendenhall, who was actively engaged on field work in Southern California during the years 1903, 1904 and 1905. His reports,

appearing as water supply papers of the Geological Survey, are remarkable for their broad constructive view of the physical situation and their simple clear presentation of a little understood subject. The essence of Mendenhall's observations can be stated in the following manner: The commercial ground waters of California occupy the voids around the particles of gravel and sand filling the closed rock basins represented by the topographic valleys. Each of these basins is a subterranean reservoir for ground water whose supply is water absorbed from flowing streams which debouch from mountain canyons and from direct precipitation.

The next step in advance was made during the years 1908 to 1911 through work carried on by the Los Angeles Aqueduct in co-operation with the United States Geological Survey. The upper portion of the aqueduct passes through the Independence basin, a typical underground reservoir of large capacity situated in Owens Valley. The water supply possibilities of this basin were early recognized by aqueduct officials. In order to ascertain the available supply with some degree of precision, the unique idea of actually measuring inflow and outflow was proposed by Mr. William Mulholland, Chief Engineer. The writer was placed in charge of the work and carried it to a successful conclusion. The practical value of the plan was recognized by the Geological Survey, and at the suggestion of Mr. Mendenhall funds were allotted to assist the aqueduct in completing the studies. The necessary data involved not only ordinary hydrographic and meteorologic measurements, but the pioneer investigation of such subjects as seepage losses from streams and soil evaporation. The assembled data has not only furnished the information desired by the aqueduct officials, but is also proving a precedent for the solution of similar problems throughout California and the whole Southwest.

Briefly stated, these intensive studies developed and proved the following principles relative to the underground reservoir. First, the natural ground water outlet is within the basin at the region of lowest depression and consists of overflow from springs and seepages into surface channels, evaporation from damp soils and vegetation, and in some cases underflow through definite channels. Second, the average annual rate of recharge by absorption of stream flow and precipitation equals the aggregate ground water loss. In other words, the reservoir formed by porous materials filling a closed rock basin gives up as much water as it receives. This is of course self-evident by comparison with a surface reservoir in an impervious basin.

The data upon which these conclusions are based included extended measurements of all the elements making up both inflow and outflow. These elements consisted of precipitation, seepage losses from streams, return water and evaporation losses from irrigation, flow of springs, soil evaporation, transpiration and other processes. All such information can be obtained by simple engineering methods and involves little expensive equipment. In fact, in many cases results of sufficient accuracy for practical use can be obtained by a few days' work with a transit and soil auger.

The application of these broad principles to practical pumping problems is a simple matter. Pumping or artesian flow consists of extracting water from an underground reservoir by artificial methods. The artificial removal of water from a basin must of necessity reduce the amount escaping by natural channels. As long as the amount permanently extracted, together with ground water escaping through natural outlets, does not exceed the amount of water absorbed, no dangerous situation arises. If, however, water is pumped so heavily that the storage is drawn upon from year to year, then draft exceeds supply. Such a condition cannot be remedied by lowering pumps and putting down more wells. The only remedy is reduced pumping.

Such is the present status of our knowledge of ground water conditions in the existing and prospective pumping districts of California, and of the whole Southwest.

The practical value of these ideas to the business operations of hydroelectric power projects is very great. The majority of such enterprises market a considerable portion of their power in the centers of population and in so doing must transmit long distances through sparsely settled territory. The advantage of building up business in this intermediate region is becoming more and more apparent. A most desirable type of load to be here developed is pumping for irrigation. This is almost entirely a day load and greatly improves conditions on a system carrying a lighting and urban transportation load.

Power companies throughout the State are now beginning to encourage in every way possible the use of electric power in pumping. There is danger, however, in overdoing such efforts. The possibility of overdraft upon underground supplies is not as impossible as is commonly believed. From the writer's own observations he has knowledge of valleys which are being recklessly overpumped. There have also come to his attention new sparsely settled districts for which the ground-water supply is pitifully inadequate for the irrigation of even a small portion of the agricultural land where expensive transformer stations and distributing systems are already installed for delivering power to the prospective settler. Such situations as these which already exist should be an effectual warning against overconfidence.

Hydroelectric power enterprises with their large and ever increasing capital investments can ill afford to be uninformed regarding the underground water situation in districts adjacent to their lines. Upon the permanence of the water supply for irrigation depends not only the market for power consumed in pumping, but also of that used in local lighting, transportation and miscellaneous farm operations. Farming cannot be carried on without water. Neither can small country towns exist without agricultural industries. Without population there is no demand for light or transportation. Hence there are definite vital reasons for possessing the fullest possible knowledge of underground water conditions.

The usefulness of such information is by no means limited to the curtailment of overdevelopment. There is another feature of underground water to which it

applies with even greater practical result, namely, the conservation and increase of subterranean supplies. There is a wide field here for the practical application of intelligently gathered data and the benefits to be derived are both increased business and insurance against trouble in times of drought. It must be remembered that extensive pumping has only occurred during the last few years, and the effect of protracted drought has not been experienced. There is no doubt, however, but that serious situations will arise in many districts under drought conditions which could be largely prevented by taking proper precautions during years of plenty.

The methods of conserving and increasing ground water supply will be but briefly described as the subject is a large one. Conservation, or the prevention of loss, may be accomplished by reducing, as far as possible waste in artificial development and losses through natural channels. Under the first item may be mentioned the common practice of allowing artesian wells to flow unchecked when not in use. This has been declared a misdemeanor by the state legislature, punishable by fine or imprisonment, but through adverse local sentiment the law is seldom enforced. The remedy is by the education of public opinion to recognize the evils of the practice. Another possible source of waste is in transmission of water to the point of use and in unintelligent irrigation. In a wide-awake community, however, such situations usually cure themselves through self-interest.

The elimination of loss through natural channels, such as evaporation from cienaga or swamp lands, is a more difficult problem. That such losses are large has been fully demonstrated not only by the Owens Valley experiments, but by agricultural investigators both in the United States and Europe. The depth of water evaporating from moist soil and meadow areas in many cases exceeds that which would occur from a bare water surface. The enormous volume of water which escapes into the atmosphere from a swamp area of several square miles, which is of quite common occurrence, is therefore evident. The remedy for this condition is by lowering the ground water plane within the area of moist land. There are several ways of accomplishing this. The one to be adopted depends on the local conditions. Pumping is involved in almost any plan, however, and it is here that the most reliable ground water supplies are to be obtained.

The increase of ground water available for pumping is to be accomplished by bringing about greater absorption of surface water by the gravels. The source of water most available for this purpose is winter flood water, which, under natural conditions, would be lost into the ocean. The storage of such water in underground reservoirs is preferable to that in surface reservoirs. In the first place there is no expensive dam and transmission system to build and maintain. Furthermore, the capacity and extent of most subterranean basins is large, and water absorbed around the rim consumes months, and even years, in reaching the region of outlet. During this period the water is protected from loss and contamination. On the other hand, water stored in a surface reservoir during a similar period would suffer severe loss by evaporation and possibly become fouled with vegetable growths. The underground reservoir is therefore far more effective in bringing about over-year storage than is surface storage. Greater absorption of flood water is thus desirable both by accomplishing greater conservation of surface supply and by providing insurance against failure of ground water supply during periods of drought.

The general method of artificial subterranean storage is to bring the water in contact with the porous gravels. This may be done either by broadcast spreading over the surface, by diversion into basins, or by diversion into shafts and pits. Each method has special features which makes it adaptable to particular local situations. The cost of such work on Santa Ana River, in Southern California, where effective work is being done, has been ridiculously low, compared with the value of the water stored. Although the feasibility of power enterprises engaging in such work might not be evident, yet there is no question but that in many districts subterranean storage of flood waters would be to their benefit.

With these statements relative to the practical value of knowledge of local ground water conditions, the writer will outline a general plan for the intelligent gathering and use of such data. There are two situations which present themselves. First, the management of a proposed or existing project is desirous of roughly ascertaining the desirability and amount of the maximum reliable pumping load of a new district. This involves a rough preliminary investigation, which can usually be made in a few days by an engineer experienced in applying the methods which have been previously described. The results of such an investigation would in most cases be sufficiently reliable to determine the approximate dependable load in the district and its desirability as a field of operation.

The other situation is that of an operating company definitely planning to enter, or already established, in a district. Such a company should desire definite knowledge of the permanent yield of underground water to be obtained from the district, the possibilities and methods of conserving and increasing the supply, and the exact relation of ground water supply and demand at regular future intervals. This information involves a more extended and detailed study. This the experienced engineer could plan and carry on with the help of one or more technical assistants. The work in connection with keeping a progressive record of ground water conditions could well be done by company employees under the supervision of the engineer.

A detailed study of this kind would consist of (1) the tracing out on the ground of the boundaries of each separate underground reservoir and a study of the geologic formations; (2) the locating of existing wells with all obtainable data, including the log; (3) the determination of the position of the water table throughout the basin from well measurements; (4) determination and measurement of natural ground water losses; (5) if possible, checking ground water losses by accretions; (6) making observations neces-

sary to formulate plans for the greatest conservation and artificial increase of ground water supply. The data needed for watching the condition of the supply are measurements of depth to water in wells, records of the amount of water developed from the basin during stated periods, and information regarding new wells. The time spent on detailed ground water studies should, of course, be proportionate to the importance of the supply and the extent of the company's business within the basin.

In conclusion it can be said that underground water supplies are a permanent natural resource as long as they are not drawn upon too heavily. The extent to which they may be safely used in any district can in most cases be determined with reasonable accuracy and cost. Self-interest and good business principles should lead hydroelectric power companies to obtain and be guided by expert opinion, based on accurate data when formulating business policies regarding the sale of power for pumping.

IMPORTANT POWER HEARING AT DENVER.

Right of Federal Government to Interfere With Power Developments on Public Lands Involved.

A suit in equity of the United States against the Utah Power & Light Company, successors to the Telluride Power Company, is being argued before the United States circuit court of appeals at Denver.

The Department of Agriculture regards this case as the most important that has come before the courts in years affecting public lands, and similar interest is shown in it by the representatives of the power companies. Upon the favorable interpretation of the law by the courts in this case depends an immense revenue to the federal government, as well as the establishment of the government's right to control public lands used by power companies for the development of hydroelectric energy.

The government contends that the power companies that locate on public lands since 1896 must do so under permission from the secretary of the interior; and that, unless they have that permission, their presence on the land is wrongful—and particularly their presence on national forest lands. If the government is successful in the present case, the power companies will have nothing except the permissive right to build flumes and construct reservoirs in national forests or on other public lands. If the companies are successful, the decision will virtually give the power companies a vested right in the reservoir sites and the right-of-way of the flumes, by the act of 1866.

The present case involves a reservoir site of about fifteen acres and right of way for about a mile and one-half of flume in Logan canyon, Cache county. The Telluride Power Company, predecessor of the Utah Power & Light Company, went on the land in question in 1900. The site was placed within the confines of the Cache national forest in 1905.

The government bases its claim to control of the lands on which the plant is located under an act of Congress passed in 1896, which provides that the secretary of the interior may give permission to hydroelectric power companies to place reservoirs and flumes on power sites in public lands. Under this law, particularly in national forests, a rental is usually charged by the government, the rate of which varies with the importance of the plant so located.

On the other hand, the Utah Power & Light Company, and with it other power companies of the west, claim that their right to go on the public land is based on an act of Congress passed in 1866, which made provisions for companies to obtain rights on public lands for sites for manufacturing purposes.

The two important contentions of the government are that under the act of 1896 it is the duty of the power company to obtain permission to establish its reservoir and flumes from the secretary of the interior; and that the act of 1866 was passed prior to the time when hydroelectric power plants were known as commercial enterprises. The act itself provides that the companies could obtain rights for flumes and reservoirs for manufacturing purposes, and the government contends that "manufacturing purposes" cannot be held to cover hydroelectric plants, because such were unknown at that time.

The government will argue that provisions of the act of 1866, so far as they relate to hydroelectric plants, are impliedly repealed, at least in substance, by the act of 1896, which refers to the latter specifically; or if not so repealed that the act of 1896 establishes an exception, and at least its provisions are the controlling rules in such cases.

A similar ruling, it is stated, to this contention, has been already made by the government in a case affecting reservoir rights on the Rio Grande river, where the court held that the law of 1896 was controlling.

The case was, however, decided adversely by the district court in Utah last June; and the government appealed, resulting in this new hearing.

The first threshing machine, so far as is known, operated by electric power in Idaho, was installed in the Hagerman valley this season. D. Dilatush threshed all of his grain this year with an electric outfit, and the Vader ranch has installed a motor for running their thresher. The electric drive is a complete success, and appealed to the farmers in view of the fact that there was no smoke or danger of fire.

The electric vehicle is steadily gaining in popularity. This is evidenced by recent statistics of some of the larger cities. In New York there are now 498 electric pleasure cars and 1,700 electric trucks; in Chicago, 2,200 pleasure cars and 630 trucks; in Washington, D. C., 654 electric pleasure cars and 255 commercial trucks; in Boston, 282 passenger cars and 261 commercial; and in Denver, 850 pleasure cars and 37 trucks.

Electric Truck Performance.—At the conclusion of the California State Fair the exhibit of the Edison Storage Battery Supply Company was loaded on a one ton truck built at San Leandro, Cal., and equipped with Edison batteries. The load aggregated 1,600 lb. and was carried from Sacramento to San Francisco, via Stockton, Livermore and the Dublin Hill Road. This is the first electric on record to have made the trip as stated and those interested in the building and equipment of the truck are naturally elated over the performance.

EDISON DAY.

Thirty-four years, and there are still those who persist in the statement that "electric lighting is but in its infancy." Rather it has reached the maturity of its Carbon Age and as it passes, someone hurriedly suggests that its genius be honored.

The carbon lamp is dimming and will soon be burned out.

There are anniversaries which are especially observed every five, ten, twenty-five, fifty, or one hundred years, but it is probable that none other than Thos. A. Edison could have thrust upon him a special anniversary during the thirty-fourth year of the life of the incandescent carbon filament lamp which he made possible. But the decree has gone forth. October 21, 1913, is Edison day and all should be glad that for once, an opportunity is afforded us to honor the inventor.

Thos. A. Edison and His Friend, Dr. Chas. P. Steinmetz.

Purpose, patience and persistence make performance possible.

There are few who can appreciate the difficulties of those pioneers who endeavored to perfect a small electric lamp which would operate successfully while using a sub-divided current, from mains supplied by crude dynamos, "the rattle and throb of which made the ground shake beneath one's feet."

Starr of Cincinnati invented in 1844 a lamp which anticipated in many ways the carbon filament lamp which was later perfected by Thos. A. Edison. This was actually a race of many brains toward the practicable and the great credit is due the Wizard of Menlo Park in that he stuck to his purpose in spite of opposite scientific thought of that day which affirmed that commercial lighting with small sized electric lamps was not practicable.

To accomplish the "impossible" makes man immortal.

Thos. A. Edison produced his first lamps and placed them in actual use. To the enthusiast it matters not who accomplishes the "impossible" provided the thing is done. Mr. Edison undoubtedly pays tribute to contemporary investigators and willingly shares the honors of accomplishment with his faithful assistants without whose co-operation the days of accomplishment would certainly have been delayed.

His was a Herculean task, so let us honor him while we may; not that the passing of this great invention will prevent our doing this in the future also, but it is well that we too fully awaken to our opportunity.

Kings and kingdoms have their birth, reach maturity, and pass away; a need is seen, a genius expressed, and his work, too, passes; in hamlet, city, and mart, everywhere, the individual does his part,—contributes to the genius of the day,—and this makes history and marks a nation's greatness. Let us each do our part.

Some of the very earliest Edison lamps were used on the Pacific, being installed on the steamship Columbia, one of the first vessels to be equipped with an incandescent electric lighting system. The lamps were of the carbonized paper filament type, gave sixteen candle power, and consumed about one hundred watts each; as efficiency of less than fifty per cent that of the present day carbon filament lamp.

The so-called metalized carbon filament lamp, the metal filament lamp,—the tantalum, and tungsten and finally the Mazda lamp, each with its increasing efficiency, have now brought us to a place where we are able to obtain six times the amount of light as that given by the early Edison lamps for an equal consumption of current.

The joy of creative effort and the impulse of self-expression leave their impress on the times.

While the prices of other commodities have increased, the cost of electric light to the consumer has steadily decreased. In a large measure, invention is responsible for this very desirable condition which is at the same time a rebuke to those responsible for the high prices of other commodities. We pay for losses occasioned by ignorance and indolence and when we as a race overcome our mental laziness we shall enjoy greater comfort and convenience and the cost of living will be no longer high.

Viewed rightly obstacles disclose opportunity and opposition is found to aid.

Those of us who had no schooling and so "never had a chance," were weaklings or discouraged early in our efforts might well read the history of Mr. Edison's achievements for inspiration and encouragement and as a check to our excuses.

Thos. A. Edison is an example to us to make good. Let us stop to honor him on this thirty-fourth anniversary of his greatest invention.

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POWER AND GAS

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Safety Calls For Action

There is an inclination to ridicule and rail against the cumbersomeness of big corporations, so slowly they sometimes move. Although not absolving the corporation in any way for its neglect, it would be indeed interesting to puzzle out just who would be to blame had an accident occurred on the railroad where twelve months after having been instructed by a State commission to install a needed protective device, no action had been taken either by the corporation or the commission.

We may go black in the face passing resolutions, burst the covers endeavoring to contain the rapidly added laws, but none of this will benefit the people unless the resolutions are carried out and the laws enforced.

Under such circumstances, twelve months is an age untold, and the man on the street may well mutter.

Hours should be the limit for the installation of protective devices ordered by a State commission, and during the time which must elapse before the device is permanently installed, satisfactory temporary precautions should be taken. A commission appointed through the power of the people and acting in their behalf is equally responsible to them, hence the difficulty in puzzling out just who would be to blame should an accident have occurred under the stated circumstances.

The powers of such a commission are not only perceptive but regulative, and the necessary protective regulation should follow immediately the need is perceived.

The Farm Servant

In European countries it is not unusual to hear of life-long servants who work on the farm for a pittance; poor, yet faithful and reliable; tireless, too, until Death gathers them,—they are retainers rather than servants, father and son each occupying the same job in succession.

But in a country teeming with opportunity for all, labor is not so constant toward the employing famer. There are no ties of sentiment, and too often the farmhand but holds his job until he finds something better. This class of labor, restless as quicksilver, is the same as that employed on large construction work on which there are always three full gangs—one gang going, one working on the job, and one coming. It left a tired farmer reaching out after a servant at once tireless, reliable, constant and low-priced.

The one suggestion better than that of the real estate man who advises that you "Follow the Trolley," is "Anticipate it," and this, in many instances, was done by the farmer, although not always intentionally. The invariable accompaniment to the network of trolley lines aggressively woven throughout our western lands is the central station power lines which press out even farther, and it was from these that the farmers' help was to come.

These power wires found the farmer eager to employ, for electricity proved for him to be the tireless, reliable, cheap and constant servant he had searched so diligently to find.

But it is true, too, that they profit most who serve best and while power companies usually discounted the future in making rural extensions, electric power on the farm proved so popular and found so many applications that the load has almost immediately proven profitable. Due to business resulting from rural extensions some Western central stations have reversed the usual order and point, perhaps with pardonable pride, to an annual peak which occurs in the summertime.

Elsewhere in this issue is information of importance to the central station regarding the introduction and use of "the tireless farmer" which electricity now is and a news item of moment marking another stage, Electrical Threshing, in the development of this important new field.

The telephone and interurban car have destroyed the farmers' isolation, motors have provided reliable servants at the hour and season required, the farmer's wife enjoys a house electrical with all the comfort, convenience and cheeriness, that circumstance contains, and so removing everything undesirable from life on the farm, the power of electricity beckons irresistibly, "back to the land."

Underground Water Supply

Swiftly the rope passed through our hands in boyhood days, as the oaken bucket raced down to lift cool water to a thirsty lad. We drank our fill with never a thought whence it came; whenever we wanted it down went the bucket and always returned filled to the brim. There was enough and to spare. Then came the pump and we found further uses for the stream which poured forth; we gave the stock well-water then, instead of taking them down to the pond. 'Twas easier. Followed the aermotor with its tank which kept an up-to-date system in the house supplied, besides our previous wants, and truck garden and lawn drew their measure also. We had found new uses.

Right to our door then came the central station man with his wires and the power pump was installed. We enjoyed this service, for the chores were easier. More home acres were brought under cultivation, more stock added, for all we had to do was throw in the switch and so much water came we were inclined to waste it. Then one especially dry season things happened contrary to expectations. First the water came just as it did from the old oaken bucket, clear as crystal; soon it came clouded, then too thick to drink, and soon afterwards we found we were pumping sand. We raved at the central station man and blamed him for the failure of our supply and with his usual good grace he assured us that we must sink the well deeper and so tap larger reservoirs. This done, he repacked the plunger, fixed the valves and set the pump going again. There were plenty of opportunities presented to us to waste water but after this experience we discontinued the abuse of our supply.

With the rapid settlement of the land in parts where irrigation is essential this boyhood reminiscence will have its application and value. To the central station man building a distribution system to care for this business and with capacity for the great future which his mind's eye pictures, and basing his expenditures upon carefully prepared estimates of possible business, there comes the revelation that there is still one item which can and ought to be investigated that these estimates may prove still more reliable. It is an investigation the results of which will still further improve central station service and remove all doubt as to the possibility of the discontinuance of that business through failure of water supply.

The man who buys and the man who sells also may each be in a quandary, for it is essential that they too, know exactly the amount of water available for the permanent irrigation of the tract. More important to such districts than all precipitation and temperature records, surveys and soil analysis reports, is this question of the permanency of underground water supply, and a very necessary protective and educational function of government should be carried out in the compilation of reports giving accurate data on this important subject, which might also be used as a basis for a new conservation.

In other columns of this issue appears an article bearing upon this subject, which should prove of great interest to every reader—so closely are we all related to the success of the soil.

Dynamite and the Suffering

The power of ignorance to appal is latterly most apparent. Crazed by the abuses of others, weaklings aim to destroy the thing abused. Colossal engineering feats convey to them no sense of the required service which erected and maintains them.

Neither is it to be expected that they know just what they do, for even the most ignorant of men, the most prejudiced against capital, those who hate most the thing they think oppresses, are kind when it comes to caring for the sick and suffering.

In our large cities, accidents are of frequent occurrence and sickness also causes suffering and in the care and alleviation of these, central station power is largely used. The destruction of a plant or transmission line, placing the central station out of commission, inflicts a hardship upon those injured or incapacitated by sickness at that time. Unkindness is not a trait of the workingman and a realization of the suffering alone caused by the destruction of central station property should make men pause and seek out a juster way.

Uneasy lies the head responsible for the continued operation of central station power plants.

There are others injured also by hindrance, delay and loss; those who can ill afford it. Who knows too the mission of the human freight carried by our trolley cars and halted because of interrupted service. Have a care, workingmen of the west, or your unintentional injuries will arouse antagonistic public opinion to injure you the most.

Trade disputes can be satisfactorily settled only by dispassionate understanding based upon exact knowledge. The fever of force fails ever and the fight is won by co-operation of the cool and calm.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Geo. Anderson, civil and hydraulic engineer of Denver is at San Francisco.

Geo, Peirce, manager Santa Monica Bay Home Telephone Company, is at San Francisco.

G. L. Jacobs, representing C. L. Cory, is at Los Angeles on professional business.

J. G. Pomeroy has opened offices in the San Fernando Building, Los Angeles, as manufacturers' agent.

F. L. Kinsey will in future have charge of advertising for the Bridgeport Brass Company, Bridgeport, Conn.

B. M. Smarr, illuminating engineer, General Electric Company, San Francisco, has returned from the East.

Jack Duhan, Montana Electric Company, Butte, Mont, has been apointed manager to succeed the late **R. C. Kemp.**

H. A. Greene, formerly advertising manager Bridgeport Brass Company, is now located at the company's New York office.

E. C. Jones, chief gas engineer, Pacific Gas & Electric Company, attended the American Gas Institute Convention at Richmond, Va.

F. W. Gay, mechanical engineer, and **Geo. F. Chellis**, electrical engineer, J. G. White Engineering Corporation, were at Bakersfield last week.

J. W. Van Huysen, district manager of the General Electric Company, located at Fresno, Cal., was a visitor to San Francisco during the week.

Geo. M. Robinson, engineer Board of Underwriters of Pacific Coast, is attending the Municipal Fire Protection Association Convention at Philadelphia.

P. D. Kline, general manager, Ogden Rapid Transit Company, attended the annual convention of the American Electric Railway Association at Atlantic City.

Geo. Culbert, in charge of the stock records department of the Pacific States Electric Company, San Francisco, left on his honeymoon trip the early part of the week.

Jos. L. Bradfield, supervising engineer, National X-Ray Reflector Company, is at San Francisco and before returning to Seattle will make a business trip throughout southern California.

H. S. Clark, of Westinghouse, Church, Kerr Company, Sau Francisco, left for the East recently where he will attend the railway convention and will also visit the various manufacturing centers.

Geo. Hewins, general superintendent of construction, J. G. White Engineering Corporation, has returned to San Francisco, having completed a tour of inspection of the company's construction work.

Simon Bamberger, president of the Salt Lake & Ogden Railroad, who is now making an extended tour in the east, will attend the Atlantic City convention of the American Electric Railway Association.

Joseph S. Wells, general manager, **Will Browne**, auditor, and **F. E. Hansen**, claims adjuster of the Utah Light & Railway Company, attended the American Electric Railway Association Convention at Atlantic City.

D. D. Morgan is at the Crocker Street Hospital, Los Angeles, recovering from a rather serious accident encountered while returning by automobile from the Big Creek plant of the Pacific Light & Power Corporation.

C. L. Winston, chief engineer, Kellogg Switchboard Company, arrived in San Francisco, but would not talk shop. This is a honeymoon trip and Mr. and Mrs. Winston are returning to Chicago via British Columbia and the Canadian Pacific Railway.

R. D. Cleavenger, popular salesman of the Phoenix Glass Company, is at San Francisco and is sending out advance postals as above reproduced, announcing his visit to other coast cities. To date, the postals have not been excluded from the mails.

Guess?

T. N. Gilmore, engineer in the construction department of Westinghouse, Church, Kerr Company, and temporarily located at Vancouver, B. C., where his company has large construction work in progress, was a recent visitor in San Francisco.

R. B. Clapp, formerly with the sales department of Westinghouse Electric & Manufacturing Company, Los Angeles, has resigned from that concern to become associated with the sales department of the West Sacramento Land Company. Mr. Clapp will continue to reside in the southern city.

James F. Rogan, at one time connected with the old Los Angeles Electric Vehicle Company, is agent in that city for the Edison Storage Battery Supply Company. Mr. Rogan has had a large experience in the automobile business and is well known and extremely popular among the automobile and electrical fraternity.

John C. Jones, local manager Westinghouse Electric & Mfg. Co., Salt Lake, has left on a visit to the Westinghouse factory and works at East Pittsburgh. While east he will attend the American Electric Railway convention. **L. M. Cargo**, district manager for the intermountain country, with headquarters at Denver, will take charge of the Salt Lake office during Mr. Jones' absence.

MEETING NOTICES.

Portland Electrical Contractors' Association.

This association held their regular meeting at the Portland Commercial Club at 6:30 p. m. Wednesday, October 8, 1913. Refreshments were served.

Joint Pole Committee, Portland.

This committee has met and organized. The following officers were elected: Chairman, C. B. Coldwell; vice-chairman, H. R. Wakeman; secretary, W. T. Herron.

San Francisco Electrical Development League.

The league met at Tait's Cafe, and held a business meeting. There was considerable discussion of matters of interest to the League, the most important outcome being that it was decided to publish a bulletin for distribution, on the Uses of Electricity.

Los Angeles Jovian Electrical League.

A. K. Mohler, railway engineer of the board of public utilities, discussed the Union Station plans at the last Jovian lunch. Mr. Mohler is opposed to the construction of the proposed depot on the Arcade site, chiefly from the standpoint of the inadequacy of plans presented for providing for future development.

Sons of Jove, Los Angeles.

The Jovians will hold another rejuvenation at the Union League Club, on Monday evening, October 13, 1913. The degree team is comprised of the following: Jupiter, J. G. Pomeroy; Pluto, T. E. Burger; Mars, A. L. Spring; Neptune, H. B. Lynch; Vulcan, J. E. Macdonald; Hercules, K. E. Van Kuren; Apollo, H. K. Fish; Mercury, J. N. Colkitt; Avrenim, P. C. Ensley.

Los Angeles Section, A. I. E. E.

Ernst M. Schmelz is to present a paper on "Electric Steel Furnaces" before the Los Angeles Section of the American Institute of Electrical Engineers, on Tuesday evening, October 21, 1913. Mr. Schmelz is erecting a steel furnace for the Warman Steel Company at Redondo Beach, which has contracted with the Southern California Edison Company for furnishing power. The plant is expected to be in operation in a few days and will, for the present, turn out high-grade steel castings.

Oregon Society of Engineers.

Regular monthly meetings have been resumed. A large and enthusiastic attendance marked the opening meeting addressed by President Foster of Reed College, who chose for his subject "Ultimately Practical Education," emphasizing especially the necessity for character building. The discussion showed that those present considered that if the student is aiming toward a finished course leading to the highest degree his work should be that which would broaden and lead to the use of initiative, while the practical engineer who is to execute the plans of the former does not need to be so extensively schooled.

Utah Electric Club, Salt Lake City.

At the regular luncheon Joseph R. Murdock, president Utah Lake & Irrigation Company, gave a talk on the subject of "Reclaiming the Arid Lands of Salt Lake Valley by Electricity." He outlined the plans of his company wherby they are pumping water from Utah Lake with electrically operated centrifugal pumps into a canal 100 ft. above the lake level. From this point the canal runs north through a fertile tract of land on the west side of Salt Lake valley, bringing under irrigation of 15,000 acres of land. Their plans contemplate the installation of additional units and another canal at a 200 ft. elevation, which will irrigate as much more land as the present one.

A musical program was furnished during the luncheon under the direction of Mr. Fred C. Graham.

Portland A. I. E. E. and N. E. L. A.

Eighty-nine members of the local sections of the American Institute of Electrical Engineers and the National Electric Light Association motored to the automobile grounds on the Sandy River where the first of a series of joint meetings of these societies was held. E. H. West, chairman of the local N. E. L. A. section, was chairman of the joint meeting.

J. E. Davidson directed attention to the advantages offered by these societies to young engineers and predicted that at no far distant date, Western branches of all national societies would split from the parent associations and form a new organization for the reason that the problems of the East and West differ so materially. Although the cost of publication of transactions of national bodies is prohibitive, they do not contain much data of interest to the West and the division would distribute the cost more fairly.

Franklin T. Griffith gave an address on the operation of public utilities and their relation to the public. He contended that the day had passed when a public utility could be operated as a private enterprise, as the public was in partnership —a silent partner that must be considered in all its dealings. He believed that as the years roll around there would be a better feeling created btween th public and th utilities.

E. F. West urged the older members, especially those holding Fellowships, to be more regular in their attendance at meetings. This was the only way to prove worthy membership. The inaugural meeting was a great success.

JOVIAN REJUVENATION AT LOS ANGELES.

The third rejuvenation under the regime of Statesman R. B. Clapp, was recorded on Monday evening last at the Union League Club. The usual dinner preceded the rejuvenation. J. G. Pomeroy acted as toastmaster, and was successful in making almost everybody either talk a little or tell a story. The several courses were interspersed with singing—socalled —and this would have been very enjoyable had it not been for Johnny Morris and the rest of the "We sting house" bunch singing off key. The serious end of the program was directly in charge of J. N. Colkitt, Alternate Statesman, and was carried through very smoothly, the degree team being of a very high order. The following candidates were admitted: James F. Rogan, A. H. Rees, H. E. Thornburgh, J. H. Fenton, H. C. Barnes, H. J. Horne Jr., J. Harry Pieper, H. W. Harrison, Lorne M. Meyer, John Glasstitter, Chas. Ohlson and W. S. Johnson.

TRADE NOTES.

Removal of the Stewart-Fuller Company office to room 2, 121 Second street, from Stevenson street, is announced. It is not anticipated that the excellent service of this company will be interrupted in the slightest due to this removal.

Ne Page, McKinny & Company, have been awarded the complete electrical installation contract for the new Pantages Theatre being erected for Alex. Pantages at Victoria, B. C., the contract amounting to approximately $8000. Jesse M. Warren, Victoria, B. C., is the architect for the building.

The Cutler Hammer Manufacturing Company, Milwaukee, has recently opened a new district office in Cincinnati in the Fourth National Bank Building. Horace L. Dawson, formerly of the engineering department and latterly one of the sales engineers connected with the Chicago office, will be in charge.

NEW CATALOGUES.

Tregoning Electric Manufacturing Company, Cleveland, Ohio, have issued Bulletin No. 5, which consists of several loose leaf pages listing Tregoning specialties—rosettes, shadeholders, receptacles and plugs.

A pamphlet on Flexible Steel Armored Conductors has been issued by the Sprague Works of the General Electric Company, which gives a short history of electric wiring and information regarding "BX" Cable.

Sprague Electric Works of General Electric Company, are distributing Bulletin No. 850 on Industrial Ozonators These ozonators may be used for ventilation and air purification, for the purification of water and for many industrial purposes.

The Ohio Brass Company, Mansfield, Ohio., are mailing a folder describing the National Railroad Trolley Guard designed for protection against accidents at grade crossings. Holabird-Reynolds Company, San Francisco, and R. D. Holabird, Los Angeles, are agents.

Bulletin A4115, entitled "Electricity on the Farm," issued by the General Electric Company constitutes an exhaustive treatise on this important subject and covers lighting for the farm, the uses of electricity in the farm home, and the advantages of electric drive. Applications of motors are profusely illustrated and accompanied by practical suggestions, together with cost comparisons of electrical equipment with other forms of power. This section of the bulletin also covers the use of electric vehicles on the farm. Irrigation is dealt with in detail, and tables are included showing the conditions encountered and describing equipments and methods of applying water in both the arid and humid regions.

The bulletin contains statistical information of a practical nature to the farmer, the central station manager, or the sales agent, and should prove of unusual interest to all those engaged in the extension of electrical service on the farm.

THE STATE OF CALIFORNIA WORKMEN'S COMPENSATION ACT.

BY J. R. MOLONY.

[Continued.]

I want to say a word with reference to the position of the insurance companies in regard to this particular bill and the whole subject. Two years ago, at the time the Roseberry Law was proposed and being considered, I sent out letters to all policyholders of our company in the state of California and some additional employers, numbering, I believe, approximately five thousand. In these letters we called attention to the very drastic change in the method of treatment of industrial accidents; pointed out that with the passage of the Roseberry law would certainly come a very marked increased cost to employers in dealing with this phase of their business. You will probably be surprised to know that we received three responses to these letters, it being quite apparent that the employing interests either paid very little attention to what we had to say or else were so little interested in the subject that they failed entirely to read our communications. Our object in sending these letters was not to oppose the theory of compensation but to call attention to this proposed change so that the employers might express their approval or disapproval of it.

Subsequent to the passage of that law and upon the announcement of the increased rates to cover an employer's responsibility under it, we were criticised severely for not having protected the employers' interests. With this experience in view and notwithstanding our efforts to put them on notice, we felt that with the Boynton Act and its extremely drastic provisions, it was necessary that we go on record in opposition to such parts of that bill as seemed unreasonable under the circumstances and to do our utmost to bring home to the employers an appreciation of what this bill meant in its application to their business. It was with this in mind that we sent out the literature from our office, which was undoubtedly received by your members. I presume all of you gentlemen know of the stand taken by the Aetna Life Insurance Company and I believe you will agree with me that it was a proper one.

However, having made our fight against the obnoxious features of this bill, we feel that it is incumbent upon us to point out quite forcibly at this time the necessity for cooperation upon the part of the employers, employes, state authorities and insurance carriers if this bill is to succeed in any sense of the word or if undue hardships upon the employing interests are to be avoided in the administration of it. There is no doubt but that the state authorities, without assistance from the employers and insurance companies, will be utterly helpless in endeavoring to minimize the abuses which must necessarily follow in the wake of this bill from a standpoint of exaggeration of disability by injured employes and assimilation of injuries by that same class. These two abuses in claims administration have reached a point in magnitude in the continental systems where it is questionable whether they can be successfully curtailed. If this is not done, the cost of those plans and the cost of this plan will at some day in the near future, reach a prohibitive figure beyond which it cannot be permitted to go and allow the industries of this state or other countries to live. There is no one element so well qualified to assist in holding down this cost as the employers themselves and this should be thoroughly appreciated by your own body.

In addition to this it is going to be highly essential that you inform yourselves with reference to the inspection part of this Act, which will be mentioned more in detail later. Unless you have a thorough knowledge of the requirements of this part of the Act and the power which is vested in the inspection bureau of the state, there is little question but that you will experience a great many difficulties in the conduct of your business. To my mind it is essential at this time that you learn definitely what your own obligations are and what your own rights are under this bill, so that you may not come in conflict with those interested in the administration of this Act, than it is important to go into the question of cost. Competition between insurance carriers will insure you the lowest possible cost but this competition cannot entirely take off your shoulders some of the responsibilities with which you are certain to be faced under this Act. If I can arouse sufficient interest among your members to insure the devotion of some little time to this question, I will have accomplished all that I hoped to today.

Taking up the text of the Act itself, briefly, it falls into four natural divisions. The first part of the Act, as well as the last few sections, is given over to the organization of the Industrial Accident Board, the determination of the powers of that board, and the defining of the methods of procedure under it. The second part of it is devoted to a definition of the compensation benefits payable to employes for industrial injuries and the determination of their amounts and the fixing of the responsibility for payment on the employers, irrespective of the theory of negligence. The third part of the act creates a state insurance fund to be operated upon a theoretically fair, competitive basis with other insurance carriers, provides for the organization of that fund, its management and its method of doing business, and places the entire organization under the control and direction of the Industrial Accident Board, without placing any personal responsibility upon that board for the fulfillment of its obligations. The fourth part of the act creates a safety and accident prevention bureau, definies its powers, places it under the jurisdiction and management of the Industrial Accident Board and determines the employer's responsibility with reference to the question of safety of all industrial plants, provides penalties for the violation of the obligations imposed and the manner of inflicting these penalties.

Taking up the first part of the bill, or the organization of the Industrial Accident Board, it is to be composed of three men with salaries of $5000 each, who are to have full and complete jurisdiction over the administration of all claims arising out of industrial accidents occurring in the State of California and sustained within the course of a man's employment. This board is to have original jurisdiction in all such cases and its findings, so far as the facts are concerned, are to be final. A limited review of its findings otherwise, is permitted by the Appellate courts, but there is no recourse in the event of an improper finding of fact, as it is specifically stated in the bill that all findings of this board are to be conclusively presumed to be lawful and reasonable.

In addition to having this authority over all claims arising out of industrial accidents, they are made the managers of the state insurance fund, with the same power and control as the board of directors of any private institution, which includes the appointment of all employes and the fixing of the salaries and term of office of such employes. They are then put in control of the inspection department, with equal powers over it.

The compensation benefits provided by this act are matters concerning which no insurance carrier is interested from its own personal viewpoint. We have continually pointed out, however, to our policyholders and to all employers in California, that these benefits are higher than those provided in a number of Eastern acts and the question so far as these amounts are concerned, is not one of insurance but one of finance, and it rests solely with the people of California to determine whether the industries of the state can afford to bear the burden. As this question has been determined by the legislature, there seems to be no room for argument.

Our criticism of the schedule of compensation benefits does not at this time extend to the amounts of compensation granted, but rather to the method of determining those

amounts. An entirely new theory is adopted whereby the amounts of compensation to be awarded are to be graded in proportion to the degree of disability sustained by the injured on all permanent disability cases. That is to say, if a man suffers an injury permanent in character, disabling him to the extent of 10 per cent of his earning capacity, he is to receive a sum equivalent to 65 per cent of his wage for a period of forty weeks, this being graduated up to a point where 60 per cent disability is suffered, in which event the compensation is to be 65 per cent of the weekly wage for a period of two hundred and forty weeks. Beyond that amount of disability a man is to receive 65 per cent of his wages for two hundred and forty weeks and a pension for life, which, added to his earning capacity, will give him an income equivalent to 40 per cent of his average annual earnings at the time of the accident. That is to say, if a man should suffer a disability of 70 per cent, his benefit would be 65 per cent of his wages for two hundred and forty weeks and 10 per cent thereafter for life. This 10 per cent added to his earning capacity of 30 per cent will give him, as you will see, an income equal to 40 per cent of his earnings.

There are no rules laid down in this act for the determination of the degree of disability, and out of this will arise innumerable difficulties in administration, much bad feeling between employer and employe, and a very material increase in the cost of operation, unless it is judiciously administered and the utmost care taken to hold down the degree of disability to a proper figure. In other words, you will readily see that if a man is permitted to exaggerate his disability from 10 per cent to 20 per cent and thereby receive 65 per cent of his wages for eighty weeks instead of forty, it will result in just double the cost on that injury, and if this is carried out consistently it will mean a cost to an employer, whether insured or uninsured, which will be absolutely prohibitive.

On temporary disabilities, not permanent in character, the injured is to receive 65 per cent of his loss in wages beyond the first two weeks of disability, the amounts of payments under these temporary disabilities to be limited to three years' wages, but not to extend beyond two hundred and forty weeks. In addition to these benefits, of course, the employer is to provide full medical, surgical and hospital treatment, including nursing, medicines, medical and surgical supplies and appurtenances, for a period of ninety days subsequent to the date of the accident, which is to be unlimited so far as the amount is concerned.

The death benefit is limited to an amount equivalent to three years' wages, or where no dependents are left, reasonable funeral benefits not exceeding $100 and "such further death benefit as may be provided by law." In this connection it is interesting to know that the bill which was introduced and passed by the legislature at the request of the Industrial Accident Board, which required the employer to pay a death benefit where a man died leaving no dependent, into the state industrial accident prevention fund, was vetoed by our progressive governor. So far as I know, this the first and only instance in the history of this legislation in which any legislature was ever prevailed upon to require the payment of damages in a case where a man left no one dependent upon him.

There is one other matter I believe should be called to your attention in connection with these benefits which you are required to pay for industrial accidents, and that is, where an accident is caused by the employer's gross negligence or willful misconduct, the injured employe may maintain, independently of this act, an action at law for damages in which he may recover whatever amount a jury may see fit to award him, and I wish to state here that these actions cannot be insured against, as the law specifically states in Section 35-B, that no such contract shall be valid.

The administration of these benefits will prove exceedingly difficult on account of the fact that the law provides in Section 32-B that no release of liability or settlement agreement shall be valid unless it provides for the full compensation in accordance with the provisions of this act or until and unless it shall be approved by the commission. As I have stated, the findings of fact rest solely in the hands of the Industrial Accident Commission, and on account of the many details in the act itself, it will be extremely difficult to determine when a compromise fulfills all obligations under this act. Consequently, in my opinion, a very large number of cases will have to be submitted to the board for decision before any valid settlement can be had, and this certainly will not add to the dispatch of business under this act nor hasten the recoveries of injured employes.

Taking up the insurance fund, there is little, I believe, which needs be said except that while it is claimed that competition by this fund with private mutual companies and private stock companies will be fair, it is not fair at the outset nor in my opinion can it ever be made fair. They are asking and have received all manner of subsidies which they were unwilling to forego in a discussion prior to the adoption of this act and it seems to me that this fact itself is indicative of fear upon their part that the administration will neither be economical nor efficient, otherwise how can they justify requests for subsidies out of the pockets of the general taxpayers of this state.

So far as the advisability of anyone insuring in this institution, in my opinion it would be necessary for those who wish to purchase insurance to buy unlimited contracts, otherwise they have only partially relieved themselves of responsibility, and in the event of a catastrophe, many employers will certainly face insolvency with limited insurance. I believe it will occur to you immediately that if unlimited contracts are to be issued covering all sorts of hazards, that a guarantee fund of $100,000, such as is provided this fund with which to commence operations, is a ridiculously small amount of surplus for the protection of policyholders. Usually careful buyers of insurance always look askance at any private institution with no larger fund than that between its policyholders and insolvency, and I believe there is little in the past administration of public institutions in the United States which would justify us in looking with favor upon the administration of a scheme such as this with no more guarantee of solvency back of it than this institution has. It undoubtedly will be claimed by the proponents of this bill that the credit of the state of California is back of this so-called "State Institution," but I want to call your attention to Section 36, page 23, of the printed copies of this act, which reads: "There is hereby created and established a fund to be known as the 'State Compensation Fund' * * * without liability on the part of the state beyond the amount of said fund." It is apparent from the wording of this act that the intent of the legislature, clearly expressed, is that there shall be no state guarantee back of this fund. This was clearly stated and clearly understood by the legislature that passed this act and no claims to the effect that the state's credit is behind this fund can carry any more weight than a statement that future legislatures in this state may possibly be willing to continue this experiment at a cost to the tax-payers at a later date, and if you have any fear that a legislature might be elected at some time which would decline to continue this socialistic experiment, then you must admit that this fund must stand on its own feet with $100,000 to guarantee it. It is quite apparent that this fund should present all the undesirable elements of state administration with no responsibility attaching to any of its administrators, with no financial credit so far as the state of California is concerned, behind it, with all of the difficulties of administration which usually follow in the wake of state activities and with nothing to recommend it except the possibility of its furnishing a cheap article of insurance to buyers of insurance in the state of California, which undoubtedly will be as cheap in protection as it is in price.

[To be continued.]

INDUSTRIAL

A NEW MOTOR DRIVE FOR INTERTYPE AND LINOTYPE MACHINES.

Every printer appreciates the necessity of overcoming annoyance and loss of time caused by the transposition of intertype and linotype matrices during composition. Such trouble is the invariable result of irregularities in the driving speed, due either to belt slippage with the line shaft drive, or to insufficient power or poor speed regulation with direct motor drive. The Cline-Westinghouse drive can be applied to any intertype or linotype machine in a few minutes' time and without special work. These motors have ample power to keep the speed steady at all times, even at the "break away" of the mold, and are very strong and rugged in constuction with heavy shafts and large bearings which are automatically lubricated by oil rings. The commutator and brushes of the direct current motor are of excellent construction, resulting in long life and freedom from repairs. A cover, further protects the commutator from accidental damage. Alternating current motors have neither commutators nor brushes and therefore have no parts that require attention other than the bearings.

Means of adjustment between the gear and the motor pinion are provided for in this drive so that accurate alignment is assured. The standard outfit is designed to drive the machine at the speed recommended by the manufacturer, but a larger pinion can be supplied for obtaining a higher speed if desired.

Motors are suitable for operation on any ordinary lighting circuit of standard characteristics.

BENJAMIN OUTLET BOX LIGHTING UNIT FOR STREET RAILWAY AND INTERURBAN CARS.

A new lighting unit of interest to electric railway men has been placed upon the market by the Benjamin Electric Mfg. Company, Rialto Building, San Francisco. It consists of a special cast iron outlet box tapped for either ½ in. or ¾ in. conduit, a mogul screw base porcelain receptacle, with lamp grip which prevents the loosening and falling of lamps, and mica washers attached to the bottom of receptacle after wiring connections have been made. The box is further supplied with metal cover overhanging the edge and covering the receptacle and lamp base. The former is so mounted that the binding screws are accessible through the open end.

This new unit is especially adapted for series lighting on circuits ranging from 500 to 1200 volts where film cut-out for street series work is not desired. Where the use of medium screw base lamps is contemplated it is furnished with a two-piece porcelain receptacle for this purpose.

DIESEL ENGINE.

The Dow Pump & Diesel Company, San Francisco, have completed a four cycle, three cylinder type, 150 h.p., 250 r.p.m. Diesel engine directly connected to a Crocker-Wheeler d.c. generator which is carrying the full load of their Alameda plant where it was built. The first test was of 168 hours' duration, during which the consumption is stated to have been less than .61 bbl. oil per b.h.p. at half load, Star oil being used. This oil has been a drug on the market and is supplied in such large quantities by the oil companies that it is available at all times. A sale of 2,500,000 barrels was made last month at 50c per barrel.

The load was fluctuating, varying from 70 kw. to 100 kw. but the speed of the engine was constant (240 r.p.m.) The engine functioned perfectly during the test, no attention whatever being necessary for the fuel, lubrication, or speed regulation. Since the completion of this test the engine has been running regularly during the day and carries the entire load of the shops.

TRANSFORMERS FOR MANHOLES.

Manholes and underground chambers are usually damp and quite frequently are flooded, so that it often becomes necessary for the transformer to continue in service while partly or wholly submerged in water. A transformer for such service must therefore be water and air-tight. The joints between the case and cover, as well as those where the leads issue from the case, must be of such construction as to prevent any possibility of moisture entering the case.

On account of the poor ventilation in manholes, and the resultant fairly high temperature, transformers must have low temperature rise, and due to the limited space available for installation and handling, they must be compact but at the same time rugged in design.

Transformers used in such service are usually connected to the mains continuously, consequently it is essential that the iron loss be as low as is possible.

The type SM transformers made by the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., have been designed with these requirements in view.

Up to and including 50 k.v.a. capacity, type SM manhole transformers are similar in construction, with the exception of the case, outlet bushings, and low-tension terminals, to that of the well-known Westinghouse type S transformers.

The design of the 75 and 100-k.v.a. transformers is somewhat modified to enable the transformer to pass through the usual standard manholes.

Type SM manhole transformers up to and including 50 k.v.a. capacity are enclosed in cast-iron cases, the larges sizes of which are corrugated to facilitate the radiation of heat. The 75 and 100-k.v.a. capacities are mounted in sheet-iron tanks welded by the oxy-acetylene blow pipe process with the top and bottom castings cast on.

Since these transformers are made air-tight, internal pressures are developed due to the expansion of the air and oil, caused by an increase in the temperature. The air space between the oil level and the cover, however, forms an effective cushion for taking care of the expansion of air and oil.

A further precaution is usually provided by mounting on each transformer a safety device for relieving any abnormal increase in pressure.

The bushings furnished with these transformers not only prevent moisture entering the case, but are so designed that it is possible to connect and disconnect the transformer very readily. As the space in the manhole is usually quite limited, this feature is of advantage. The leads are brought from the coils through a heavy porcelain bushing and terminate in leaf connectors. Connection is made to the line by inserting the leaves of a similar connector to the lead-covered cable and tightening a bolt which is inserted in a hole passing through all the leaves. A brass sleeve with an insulating lining is slipped over the connection and screwed into the transformer case. The lead casing of the cable is connected to a flanged sleeve by a plumber's wiped joint. A nut is used to force this sleeve to a seat on the gasket in the outlet bushing, making a perfectly water-tight joint. This construction affords a most satisfactory method of connection, enabling same to be made in the limited space of the manhole without disturbing the transformer in any way, at the same time securing good contact by means of the bolt and leaf connection.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—The railroad commission has granted authority to the Amador Electric Light & Power Company to issue $12,000 of bonds to retire indebtedness, and to issue 3000 shares of capital stock.

GLENDORA, CAL.—The board of trustees has sold the $25,000 municipal water bonds to Torrence Marshall & Company for par value, accrued interest and a premium of $26. The trustees have purchased 10 acres of water bearing land for the purpose of water development, and they will let contracts at once for sinking wells and for casing and other needed supplies.

VISALIA, CAL.—The September financial report of the Central California Gas Company, which was sent to the state railroad commission this week, shows a remarkable increase in business over a year ago. President Chas. S. S. Forney accounts for this by the fact that the reduced rates now in effect are getting more business. Gas is now sold here at $1.25 per thousand feet.

ILLUMINATION.

SOUTH BEND, WASH.—Chas. Fuqua, representing H. W. Urquhart of Chehalis and John Stewart of Seattle, has asked for a franchise for a gas company to be capitalized at $75,000.

BAKERSFIELD, CAL.—The new 6000 k.v.a. turbo generator at the San Joaquin Light & Power Company plant, was started up last week and has now been put into service.

LOS ANGELES, CAL.—Plans and specifications for a lighting system in Moneta lighting district have been adopted by the board of supervisors and the county clerk instructed to advertise for bids for the same.

COVINA, CAL.—The board of trustees has awarded a contract for the installation and equipment of a lighting system in Center street, from First to Hollenbeck streets, to the Newberry-Bendheim Electric Company, for $3,974.

FRESNO, CAL.—The 1530 ft. head pipe line for the Tule River plant of the San Joaquin Light & Power Company, has commenced to arrive and is being erected. The water wheels and generators manufactured by the Allis-Chalmers Company, are also en route. The J. G. White Engineering Corporation, are the consulting engineers.

PORTLAND, ORE.—The City Commission has awarded a contract to the Portland Railway, Light & Power Company for the lighting of streets and public buildings for three years, commencing January 1, 1914. The company submitted the lowest bids for this service ever received by the city, and it is expected that approximately $60,000 will be saved.

SAN FRANCISCO, CAL.—The railroad commission has granted authority to A. A. Weber to sell to the Alta District Gas Company, a gas plant serving the cities of Dinuba and Reedley, and authorizing the gas company to operate under franchises from the counties of Tulare and Fresno. The company was also given authority to issue its promissory notes in the sum of $20,000.

RAYMOND, WASH.—Two petitions for gas franchises in this city were presented at the city council last week in addition to the one submitted two weeks ago by Urquhart & Stewart. After due consideration to all of them, the city council finally passed the franchise sought by H. W. Urquhart, of Chehalis, and John Stewart of Seattle. Under the terms of this franchise construction must commence within eight months and must be completed within 18 months,

BAKERSFIELD, CAL.—For the purpose of insuring a steady and sufficient pressure on the main which carries natural gas from the Buena Vista Hills to Los Angeles, the Midway Gas Company is constructing a $75,000 compressor plant about five miles from Taft. Several centrifugal pumps, each capable of passing 2000 gallons of water per minute, will handle the vast amount of water required to force the gas through the lines. At present water for the concrete work and for use in camp is brought through 18,000 ft. of pipe from the Western Water Company's plant. To operate the compressor plant 200,000 gallons will be needed daily, and the company is preparing to develop its own water. Two rigs are up and one well is drilling.

LODI, CAL.—It is reported that T. P. Wickershaw, president of the Western States Gas & Electric Company, is negotiating for the purchase of the local gas plant. At present the city of Lodi is planning to buy the plant for a municipal gas system. The plant is owned by the Sacramento Natural Gas Company, which wishes to dispose of it and is willing to give the city of Lodi the first chance to purchase. The board of city trustees will take up the matter at an early date and if the proposition is a favorable one, will submit it to the voters.

TRANSPORTATION.

SAN DIEGO, CAL.—Plans have been filed for a big concrete barn for the San Diego Electric Company. It will be erected on Adams street, just beyond Mission Cliff gardens.

LOS ANGELES, CAL.—The city council has taken steps toward acquiring a new depot on the Arcade site. A resolution has been passed, instructing the city attorney to draw up the necessary contracts for the track changes.

RIVERSIDE, CALIFORNIA.—Erle L. Veuve has completed the appraisal of the Crescent City Railway system, between Riverside and Crestmore. This line is now being extended to Rialto, where connection will be had with the Pacific Electric Railway. Riverside citizens expect to get direct electric railway service by this route to Los Angeles upon completion of this link.

LOS ANGELES, CAL.—A special committee of the city council has made overtures to the Pacific Electric Company to have them defer for one year the payment of $247,000 on the contract price for the municipal railway, in order that this amount may be applied to harbor development. It has been suggested that the railway company accept the amount in harbor bonds, at par, in lieu of the payment in cash. This matter is now under consideration.

IDAHO FALLS, IDAHO.—An interurban electric railroad of forty-two miles, with Idaho Falls as headquarters, will be constructed and completed within the next twelve months. The conditions imposed by the eastern promoters that the citizens of Idaho Falls subscribe for stock to the amount of $1000 per mile have been carried out. The money has been subscribed and the bonds, amounting to $1,500,000, have been sold to Chicago parties. It is said that work will commence within the next ten days on the grade.

ORANGE, CAL.—The Pacific Electric Railway Company has started work on the Santa Ana-Orange electrification. Orange is now served by a narrow gauge gasoline car of rather limited capacity. The car body is one of the Los Angeles cable cars of the early nineties, equipped with an automobile engine taken from one of the first gasoline sightseeing automobiles brought to Southern California. The new line is over private right of way, between Santa Ana and Orange, leaving the Santa Ana line on Main street, north of Santiago Creek and entering Orange at La Veta avenue and Lemon street.

SAN BERNARDINO, CAL.—The Pacific Electric Railway Company is making rapid headway with the Upland-San Bernardino extension. Tracks have been laid on First street, west to the Atchison, Topeka & Santa Fe Railway, From this point, the electric line will be elevated as far as what is known as the Lytle Creek bench. This necessitates some particularly heavy construction in concrete and steel. There is a prospect of a reduction of fares and running time between Los Angeles and San Bernardino on the steam roads to meet the competition of the electric line.

SACRAMENTO, CAL.—The Sacramento Valley Electric has been surveyed from Red Bluff to Woodland, and the survey was extended to Dixon and a point 7 or 8 miles from that city to connect with the Oakland, Antioch & Eastern, with which traffic arrangements have been made. Recently a survey was made from a point near Dixon to Solano City. The company has had excellent success in obtaining rights of way, many miles having been donated by the landowners. It is estimated that over 80 per cent of the rights of way have been obtained. C. L. Donohoe, president of the Sacramento Valley Electric railroad, stated that the company is now in a position to begin construction, and that bids for the grading of the first unit of the road will be asked.

TRANSMISSION.

MARTINEZ, CAL.—Work will begin soon on a new substation at Avon. The new station will be 60,000 volts and will prove a feeder for the local lines in the event of accident which would place the south tower out of commission.

LOS ANGELES, CAL.—The recently appointed efficiency bureau of the city council has recommended that the fire alarm system be turned over to the department of electricity, from which it was withdrawn several years ago.

BOISE, IDAHO.—The Idaho Power & Light Company, organized under the laws of Nevada, has taken over the holdings of the Beaver River Power Company in Boise and Southern Idaho, together with all its franchises, worth approximately $1,000,000.

ALAMEDA, CAL.—The electricity department is now engaged in installing a heavy power line along the Webster street roadway to the factory district. The enlargement of the facilities at the plant have caused the extension of lines for power business in the day time.

OROVILLE, CAL.—A syndicate of Sacramento capitalists has filed an appropriation upon the waters of the middle fork of the Feather River and upon Fall River. Included in the company are F. G. Eby, S. H. Whisner and L. F. Breuner. The appropriation recites that the water is to be used for the purpose of generating electrical power and that the estimated production of the plant is 60,000 h.p.

MOUNT PLEASANT, UTAH.—The city council has completed the purchase of the local electric light company's holdings in this city and is now in charge of the operation of the plant. The purchase price was $15,000. The city is rapidly bringing its power plant in Pleasant Creek canyon to completion, and as soon as it is running the plant in town, purchased of the private company, will be closed down.

STOCKTON, CAL.—The Oro Electric Corporation has installed continuous electric service in all of the territory served by their wires, and is now prepared to furnish electric lights in addition to power. This has been made possible by an arrangement entered with the Pacific Gas & Electric Company, and approved by the State Railroad Commission, whereby the Oro Company secures its power from the older company.

VISALIA, CAL.—The Mt. Whitney Power & Electric Company, which derives 70 per cent of its revenue from pumping plants, for irrigation in the San Joaquin Valley, shows unusual earning power during the month of August. The gross earnings were $54,028 and the balance after all expenses including $9875 interest on bonds was $19,625 as against $9572 in the same month last year. For the year ended August 31st the net balance over all expenses was $159,437 compared with $132,164 for the same period in 1912.

RENO, NEV.—A water power permit has been granted the Truckee River General Electric Company, under which this company will develop power in the El Dorado national forest. The company states it expects to construct seven reservoirs, five for water storage and two for equalizing the flow. The two power plants mentioned in the permit are to be located on Pilot Creek. At each there will be a head of approximately 1300 ft. The company expects to make an initial installation which will develop 16,000 h.p., which will probably be doubled as the market for the product increases.

TELEPHONE AND TELEGRAPH.

VENICE, CAL.—Sealed bids will be received up to October 27th, at the office of the board of trustees for a franchise granting the right to construct and maintain telephone and telegraph wires along the streets of Venice.

PORTLAND, ORE.—The Pacific Telephone & Telegraph Company has made an appropriation of $55,000 to meet the cost of the conduit on Oak street, between Front and Park, according to an announcement made by Manager Fred Spoeri. The conduit is for additional cables to meet the expansion of 1913. They also have an estimate amounting to $60,000 to rebuild 23 miles of the toll lead between Salem and Aurora junction.

SAN FRANCISCO, CAL.—The California Railroad Commission has rendered a decision in which it directs the Pacific Telephone & Telegraph Company to reduce its rate for telephone service in the city of San Jose and neighboring territory. The reduction ordered is 50c per month on unlimited business and residence service and 25c per month on two-party residence service. The commission estimated the total reduction at $15,000 annually. The commission declares that the policy of the company to require an advanced deposit for telephone service is improper and must be discontinued. The commission makes special objection to heavy payments to the parent company, the American Telephone & Telegraph company.

WATERWORKS.

ENDICOTT, WASH.—The contract for the water system has been awarded to C. Cochran for $10,992.

TACOMA, WASH.—An ordinance has been passeu providing for the construction of watermains of 6 in. cast iron pipe, and all necessary work in connection, at an estimated cost of $17,621.

SAWTELLE, CAL.—Sealed bids will be received at the office of the city clerk of Sawtelle, up to November 17th, for a franchise to construct and maintain for a period of 25 years, a system of water pipes along and across certain streets, alleys and thoroughfares in the city of Sawtelle, Cal.

TAFT, CAL.—Although the general opinion of many has been that the Western Water Company's lines were complete throughout the West Side fields, the increase in the demand for water from its wells 17 miles from Taft has necessitated the contracting for material for another line to the Sunset field to cost in the neighborhood of $65,000.

SAN DIEGO, CAL.—W. G. Henshaw of San Francisco, representing a New York syndicate, has offered a proposition to the city council to develop and supply the city of San Diego by March, 1915, a minimum of 20,000,000 gallons of San Luis Rey River water at 12c per 1000 gallons daily. According to Mr. Henshaw the project includes the purchase of Warner's ranch, with which the New York syndicate controls 90 per cent of riparian rights on San Luis River.

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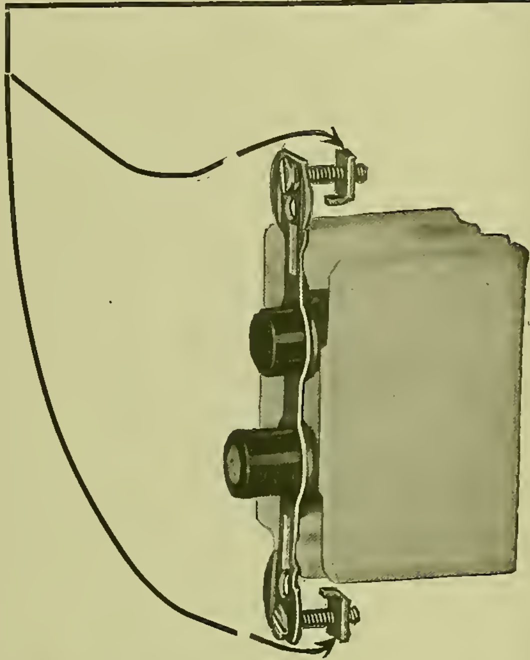

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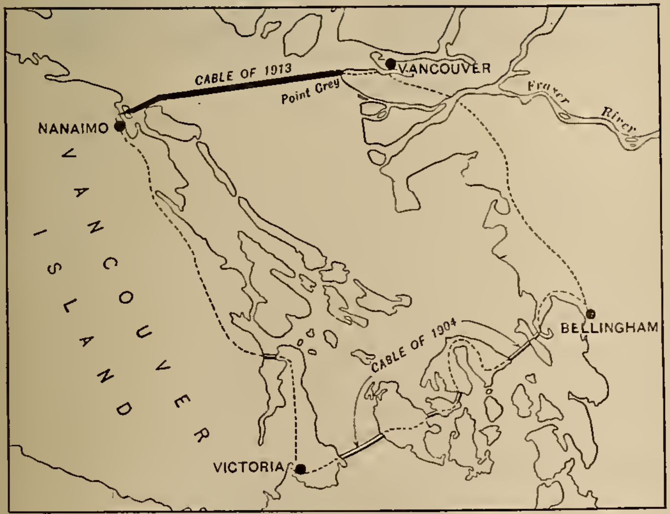
GULF OF GEORGIA SUBMARINE TELEPHONE CABLE

BY E. P. LA BELLE AND L. P. CRIM.

(The paper describes the submarine telephone cable recently laid between Point Grey and Nanaimo, on Vancouver Island, over 30 miles in length. It is continuously loaded, being the first cable of this type in use in America. The construction of the cable is described and illustrated and also the method of laying it. A careful study was made of the relative advantages of a continuously loaded and a coil-loaded cable for the conditions obtaining in this case, and the results have amply justified the selection of the continuously loaded type. The paper was presented at the Pacific Coast convention of the American Institute of Electrical Engineers at Vancouver, B. C., 1913.—The Editor.)

The recent laying of a continuously loaded submarine telephone cable, across the Gulf of Georgia, between Point Grey, near Vancouver, and Nanaimo, on Vancouver Island, in British Columbia, is of interest as it is the only cable of its type in use outside of Europe.

The purpose of this cable was to provide such telephonic facilities to Vancouver Island that the speaking range could be extended from any point on the island to Vancouver, and other principal towns on the mainland in the territory served by the British Columbia Telephone Company.



Route of Cables of 1904 and 1913.

The only means of telephonic communication between Vancouver and Victoria, prior to the laying of this cable, was through a submarine cable between Bellingham and Victoria, laid in 1904. This cable was non-loaded, of the four-core type, with gutta-percha insulation, and to the writer's best knowledge, is the only cable of this type in use in North America. This cable is in five pieces crossing the various channels between Bellingham and Victoria. A total of 14.2 nautical miles (16.37 miles, 26.3 km.) of this cable is in use. The conductors are stranded and weigh 180 lb. per nautical mile (44.3 kg. per km.). By means of a circuit which could be provided through this cable by way of Bellingham, a fairly satisfactory service was maintained between Vancouver and Victoria, the circuit equating to about 26 miles (41.8 km.) of standard cable. All communications to points on Vancouver Island north of Victoria were routed through this cable circuit. As a consequence the speaking range from Vancouver to the Island was limited to a few points near Victoria, and Nanaimo was the extreme limit of commercial service, and conversation was not attempted except under the most favorable conditions. Under some conditions conversation was possible except for the distorting effect of the unloaded cable.

By using the new cable, Nanaimo is made the center of distribution for Vancouver Island. The longest line that will ever be connected at Nanaimo will extend to the north end of Vancouver Island, and will be about 250 miles (400 km.) in length, so it can readily be seen that satisfactory service may be established to any point on Vancouver Island through the new cable. It was with the idea in mind of using Nanaimo as the distributing center that the existing route was chosen for laying the cable.

It is quite important to the long life of a submarine cable that a rock bottom and exposure to tidal currents be avoided as much as possible. It is also quite essential that the shore ends be landed in mud or sand and that they be kept buried, at least as far as the low water line. It is believed that the route chosen will prove to be very satisfactory.

The new cable was manufactured by the Henley Telegraph Works, in England, and has the following mechanical properties:

Conductors. Four conductors, each consisting of a central wire, surrounded by twelve wires of annealed copper, having a total weight of 300 lb. per nautical mile (73.4 kg. per km.); total diameter of conductor 0.1385 in. (3.518 mm.).

Loading. One soft iron wire 0.012 in. (0.305 mm.) in diameter, wound round the conductor and having seventy turns per inch (27.6 turns per cm.).

Dielectric. Three coats of best gutta-percha alternating with three coats of Chatterton's compound.

Total weight of dielectric per nautical mile 300 lb. (73.4 kg. per km.). Diameter over gutta-percha 0.409. in. (1.04 cm.).

Cabling. Four cores laid around a yarn center, wormed, brass taped and served with yarn.

Armoring. Fifteen galvanized steel wires each 9.192 in. (0.487 cm.) in diameter, separately tarred and served with tarred yarn.

Outer Serving. Two coats of tarred yarn, and two coats of preservative compound.

Diameter. Diameter of completed cable 1.956 in. (4.97 cm.).

Weight. Weight of completed cable, eight English tons per nautical mile (4.38 metric tons per km.).

The same type of armoring was used throughout, and on account of the armor wires each being served with tarred jute, the completed cable was very flexible.

The cable has the following electrical qualities, as measured on 31.3 nautical miles (58 km.) of the completed cable in the factory at a temperature of 75 deg. Fahr. (24 deg. Cent.). All quantities per nautical mile.

	Conductor resistance, Ohms.	Electrostatic capacity, Microfarad.	Dielectric resistance.* Megohms.
No. 1 Core	4.004	0.3449	258
No. 2 Core	4.004	0.3455	256
No. 3 Core	4.004	0.3449	268
No. 4 Core	4.005	0.3449	274

* After one minute's electrification.

Per Nautical Mile of Looped Circuit.

	Cores.	Conductor resistance, Ohms.	Electrostatic capacity, Microfarad.
Circuit A	1 and 3	8.008	0.1724
Circuit B	2 and 4	8.009	0.1726
Superimposed or phantom circuit on A and B...		4.0045	0.3450

The following values were obtained by an eminent independent testing authority on a length of one-twentieth of a nautical mile cut from the completed cable. Results are per nautical mile, and tests were made with sinusoidal current at a frequency of 800 cycles per second, at a temperature of 56 deg. Fahr. (13 deg. Cent.).

Column A, loop or side circuit cores 1 and 3.
Column B, loop or side circuit cores 2 and 4.
Column C, superimposed or phantom circuit.

	A	B	C	
Effective resistance R	9.16	9.14	4.69	ohms
Effective inductance L	11.56	11.54	5.45	millihenrys
Effective capacity K	0.1647	0.1662	0.3338	microfarad
Effective leakance S	12.24	11.26	19.84	microhms
Ratio S/K	74.3	67.8	59.4	
Attenuation constant	0.01892	0.01874	0.01966	

The following results were obtained in the laboratory of the manufacturers on the completed length of 31 nautical miles (58.5 km.) coiled up in the iron tank and covered with water, using sinusoidal current at 800 cycles per second, as before.

Circuit.	A	B	
Open impedance Zo	349.35	337.4	Vector ohms
	∖32°31′	∖33°54′	angle
Closed impedance Zc	185.75	187.5	Vector ohms
	∕23°53′	∕24°43′	angle
Characteristic impedance Z	254.5	251.4	Vector ohms
	4°19′	∖4°56′	angle
Attenuation constant	0.01946	0.01940	

After laying, the cable was tested for dielectric resistance, for capacity, and for conductor resistance. The transmission equivalent was measured in terms of standard cable and tests were made for crosstalks.

Summary of Tests After Laying.

	Conductor resistance	Mutual capacity
	Ohms	Microfarad
No. 1 Circuit	8.008	0.175
No. 2 Circuit	8.008	0.174

	Electrostatic capacity	Dielectric resistance
	Microfarad	Megohms
No. 1 Core	0.347	445
No. 2 Core	0.349	451
No. 3 Core	0.351	461
No. 4 Core	0.347	461

Constructional Details of the Cable.

The above results are per nautical mile. Dielectric resistance is corrected to 75 deg. Fahr. (24 deg. Cent.).

The actual length of cable in use is 28.3 nautical miles (52.5 km.) and its mean temperature was 49.6 deg. Fahr. (9.8 deg. Cent.) at the time the measurements were taken. Speech tests showed a standard cable equivalent of eight miles with zero loop on each end, and 5.75 miles, with 12 miles of standard cable at each end to reduce reflection losses.

The finished cable was shipped from England to Vancouver on the ship Crown of Galicia. It was stored in a steel tank while on shipboard and kept under water. The temperature was observed daily throughout the voyage. Upon arrival at Vancouver, it was transferred from the tank in the hold of the Crown of Galicia to the hold of the barge Princess Louise, from which it was later laid. The actual operation of laying was begun at the Point Grey end at 4 a. m. June 16, and finished at Kanaka Bay on New Castle Island at 7:30 the evening of the same day. The illustrations herewith show the laying operations in detail. Throughout the entire operation of the laying, one pair was under continuous test for insulation resistance, while the other pair was being utilized for communication with the shore. As a matter of precaution the two pairs were interchanged at intervals so that no fault in the dielectric could escape observation for any length of time. While the cable was being laid, conversations were carried on with parties in Vancouver, Victoria, Seattle and Portland. Two tugs were used to tow the cable ship, which was without power of its own. Telephonic communication was maintained with the tugs by means of rubber-covered wires strung on the hawser. Observations to determine the location were taken at regular intervals with a sector, and a log of operations was carefully kept. The tension on the cable was observed by means of a dynamometer, and the amount of cable paid out was read from the rolometer attached to the paying-out drums. With the exception of a light rain in the morning, the weather was excellent, and a number of guests observed the laying operations, which were without accident.

A cable hut is provided at each of the shore ends for housing the protective apparatus and making the connections between the cable and the aerial land lines. The protective apparatus is of the Lodge-Muirhead type, and consists of three reactive coils with four discharge points, located around a central brass disk, which is grounded to the armor wires of the cable. Each of the cable cores is laid through a protector of this type, and a fuse is inserted between the protector and the line wire, and also between the protector and the cable. All of the protective apparatus is housed in a waterproof cast iron case.

The two physical circuits provided in this cable were satisfactory in every way, and are each equivalent to about 5.75 miles of standard cable. The phantom circuit, however, is not so satisfactory. It is only fair to the manufacturers, however, to state that a satisfactory circuit was not guaranteed. It will be seen that the capacity and leakance of the phantom circuit is just two times as great as in the physical circuits, while the resistance and inductance are about one-half each. This causes the attenuation constant of the phantom to be somewhat greater than that of the physical circuits. There is also some crosstalk between the physical circuits and the phantom, being

Distribution of Magnetic Flux in Four-Core Cable, Current Flowing in Physical Circuit Only.

Distribution of Magnetic Flux in Four-Core Cable, Current Flowing in Phantom Circuit.

equivalent to about 75 miles (120 km.) of standard cable. Tests for this determination were made with local battery sets in the cable huts connected directly to the ends of the cable. This crosstalk is undoubtedly caused by inductive unbalance in the cable. On account of the salt water penetrating to the outside core of the gutta-percha, the wires are shielded from each other electrically. Any disturbance that is transmitted from one wire to another must, therefore, be of an electromagnetic nature. The capacity of the cores in this type of cable depends upon the thickness of the dielectric, and in every case is the capacity from the wire to the ground (salt water), as the sea water penetrates the cable to the gutta-percha. Efforts to decrease the capacity of this type of cable by a paper wrapping under the gutta-percha, in order to increase economically the diameter, have failed because of the moisture content of the gutta-percha being absorbed by the paper.

The uniformity of the capacity then depends upon the cores being exactly of the same dimensions and located symmetrically. It can readily be seen that a slight eccentricity of conductor in the dielectric will change the capacity accordingly.

The inductance of these cable circuits is artificially increased by a winding of soft iron wire around the copper conductor, which increases the permeability of its magnetic field. This is the well-known Krarup system of continuous loading. The permeability of this wire may be affected in three ways, namely, ageing, by straining it beyond its elastic limit, and by permanently magnetizing it. Ageing occurs in nearly all iron used in magnetic circuits, and the magnitude of the change of permeability varies with the different pieces of iron. It is thus possible that the inductance of the different cores of the Krarup cable might be thrown out of balance by the iron wires ageing differently. It is known that the permeability of magnetic iron is affected by straining it beyond its elastic limit. When it is considered that the leading wire is only 0.012 in. (0.305 mm.) in diameter, and that in order to hold it around the copper conductor so that it will remain evenly distributed, it is necessary to apply it with considerable tension, it is more than likely that a considerable amount of this wire has been heavily strained. This is indicated by its appearance. During manufacture the different sections of core were spliced together in such a way as to neutralize as far as possible any unbalances that could be detected at that time. It will be seen that the total capacities and inductances of the different cores are in a fair degree of balance. There is very little danger of the iron wrapping used in continuous loading ever becoming permanently magnetized, as this would require a very heavy current.

It is customary to measure the direct-current insulation resistance of a gutta-percha core at 75 deg. Fahr. (24 deg. Cent.), and after one minute's electrification. The insulation resistance increases quite rapidly after the initial electrification, and only reaches a fairly constant state after some time. This effect, although not well understood, seems to be somewhat similar to the polarization effect of an electrolytic couple. The dielectric resistance so obtained cannot be used to deduce the leakance S for calculating the attenuation constant and circuit impedance. Measurements for this quantity must be made at telephonic frequencies and voltage, and owing to the extremely small quantity of power involved, are exceedingly difficult to make with any degree of precision.

Gutta-percha is rarely employed as an insulator for telephone conductors, with the exception of submarine cables in deep water. While information regarding its various characteristics is not very plentiful, a brief statement of its qualities may be of interest.

It is composed of pure gutta, rosin and water. It is a vegetable gum secured from certain tropical trees very much the same as India rubber. It is collected by native labor, and shipped in the raw state to the factory, where it is prepared for commercial use. The first step in its preparation is to remove all impurities, as far as possible, which is done by boiling in water. It is then put through a masticating machine, after which it is rolled out into thin sheets.

The wire which is to be insulated with gutta-percha is first given a coat of Chatterton's compound, and then a coat of gutta-percha is applied with a sheathing machine, in much the same manner as lead sheaths are applied to the ordinary paper-insulated telephone cable. Additional layers are applied alter-

nating with layers of Chatterton's compound, until the required thickness of dielectric has been obtained. It should be noted that gutta-percha is not subjected to any process similar to the vulcanization of rubber, but is used in the raw state. It contains no sulphur, and copper wires do not require tinning before being insulated with gutta-percha.

In general, rosin does not increase the initial insulation resistance of gutta-percha, but if it is present in too great proportions it tends to separate, especially upon exposure to heat and light, and causes cracks to form in the insulation. Ordinary grades contain from five to six per cent moisture. The insulation resistance increases very rapidly with a decrease in temperature, so that at 45 deg. Fahr. (7.2 deg. Cent.) its insulation resistance is about ten times that at 75 deg. Fahr. (24 deg. Cent.). If it is heated much above 80 deg. Fahr. (27 deg. Cent.) it soon softens, and in a completed cable this would allow the cores to become deformed, especially if the cable were subjected to any considerable pressure, such as the lower coils in a cable tank. Instances have been known where the copper conductor by its own weight became so eccentric in the core that a large quantity of the cable was ruined on account of the insulation becoming too thin.

Generally speaking, if different grades of gutta-percha are mixed together, a higher dielectric resistance is obtained, but the fibrous structure is not so good as if one quality were used throughout.

The splicing of a gutta-percha-insulated conductor is one requiring no little skill and care. It is necessary in splicing a four-core cable that the spliced conductors be of equal length, so that no one splice will be subjected to more than normal stress. In splicing the conductors the ends are scarfed and soldered together. Then the joint is given a close wrapping of fine copper wire, which is also soldered all over. A second wrapping of fine copper wire is then applied in reverse direction and soldered only at the ends. In case the joint was so strained as to break the soldering in the main conductor of the first wrapping copper wire, this last spiral wrapping would still form a metallic connection across the break. In joining the dielectric, the same number of layers of gutta-percha are applied, alternating with Chatterton's compound, as are used in the manufacture of the core. The gutta-percha is warmed with a spirit lamp until plastic, and is applied with the fingers. The finished splice must not have a much greater diameter than the unspliced core and must show leakance not in excess of a piece of core ten times the length of the splice. Owing to the inability of gutta-percha to stand exposure to moderately high temperature, light and air, it has been the practice among European engineers to splice a piece of rubber-insulated cable on to the gutta-percha below the water level at the shore ends, and thus make the landing with rubber-insulated cable. As it is well-nigh impossible to make a perfect splice between rubber and gutta-percha, it is necessary to employ a water-tight junction box if this method of terminating the shore ends is used. No method has yet been found for cementing rubber and gutta-percha together so that the joint will hold for any appreciable length of time. The practice of using rubber insulation for the shore ends was not followed in laying the Point Grey-Nanaimo cable, for the above reasons. The shore ends have been buried from the terminal in the cable hut to low water, and on account of this, will not be exposed to temperature very much above that of the sea water. Sufficient slack has been left in the cable so that in case the ends at the terminals lose their insulating qualities, they may be cut off and the cable reterminated. In this way the ends of the cable may be kept in excellent condition by allowing a few feet extra for the cable reterminating.

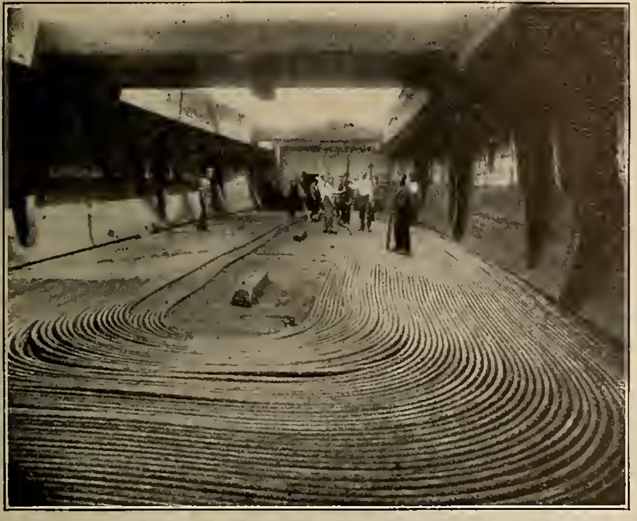
In a four-core cable, such as is generally used for telephone purposes in deep water, the two opposite cores are used to form each circuit. It is not necessary, if the cores are arranged symmetrically about the center, that the wires be twisted in pairs in order that each circuit will be unaffected by the current flowing in the other. The wires of one circuit do not interloop the lines of magnetic force from the other, and each of the wires is under the influence of equal and opposite electrostatic fields. This latter is not true of a cable submerged in salt water, due to the shielding effect of the salt water. As mentioned before, it will therefore be seen that the two circuits are quite independent of each other, both electromagnetically and electrostatically. The same thing is true of the superimposed or phantom circuit, but the results obtained in practice are not so good as with the two physical circuits.

In selecting a design of cable suitable for this service, the choice was practically limited to a four-core gutta-percha cable, loaded either by the continuous Krarup system, or by the use of Pupin coils. Owing to the depth of water (1300 ft. = 396 meters) a paper-insulated lead-covered cable was not seriously considered. The stress during the laying would so strain the cable in passing over the drums and sheaves that there would be great danger of impairing the insulation between the wires. Owing to the highly distortional effect of non-loaded gutta-percha cable, it was necessary to eliminate such a cable from consideration. It remained, therefore, to choose between the two types of loading. It is well known that a coil-loaded cable is quite superior to a continuously loaded cable, or, in fact, any other design of cable when electrical qualities alone are considered. The continuously loaded cable is mechanically quite simple, and upon its completion is equally as strong as a non-loaded cable, such as has been used for telegraph service for years, even at the maximum depth of the ocean. In a coil-loaded cable the only acceptable design of coil so far employed is one which surrounds the four cores of the cable, and which is taken inside the regular cable armor. This causes an increase in the diameter of the cable from two to three times its unloaded diameter, and in spite of precautions which may be taken in the manufacture, these loaded points are the weakest spots in the cable, both electrically and mechanically.

The two best-known examples of coil-loaded submarine cable extend from England to France across the English Channel, and from England to Belgium. The former cable is about 20 nautical miles (37.1 km.) in length, and the latter about 40 nautical miles (74.2 km.) in length. Neither of these cables is laid in a very great depth of water, and both are under the supervision of the British Post Office, which has avail-

able cable ships especially designed for the laying and repairing of such cables. The older of these cables has only been in use about three years, and during this time no serious case of trouble has developed, so that the actual difficulties to be encountered in repairing this type of cable can only be forecasted in view of experience in repairing the non-loaded type.

In order to keep the transmission in a coil-loaded cable at its original quality, it is necessary that the spacing of the coils be kept as originally laid out, allowing only a variation of five per cent. It is quite obvious that this is not true of the continuously loaded type, and any increase in the length would cause an increase in the transmission loss, only in proportion to the increased length of the cable employed.



Coiling of Cable in Hold of Princess Louise.

In case of a fault in deep water, the cable is picked up by means of a grapnel, and as soon as it is brought to the surface it must be cut in order to relieve the great strain. One end is retained in the grapnel and a line is made fast to the other end, which is thrown overboard and a buoy attached. The end which is retained is tested for the fault, and unless the fault is in the cable which was thrown overboard, the cable is picked upon until the fault is located and repaired. It is then necessary to splice in a piece of new cable and pay out until the abandoned end is picked up, when as much slack as possible is taken out and the two ends spliced together. It will thus be seen that a considerable additional length of cable will be introduced in case of a fault in very deep water. In case such a repair was made at a depth of 1300 ft. (396 m.), under the most favorable conditions, it is quite probable that 800 to 1000 ft. (244 to 305 m.) of additional cable would be introduced. As 300 ft. (91 m.) is the greatest allowable variation with coils spaced one nautical mile (1.854 km.) apart, it will be seen that the coil spacing would be badly disarranged and serious reflection losses introduced. It must also be remembered that no gutta-percha cable is manufactured in America, and the only submarine loading coils so far manufactured have been made in Europe, and in case expensive repairs were necessitated, it might be necessary to secure special equipment and skilled labor from Europe, while with the type adopted, repairs can be made with the equipment and labor commonly used in repairing telegraph cables.

Comparisons between the two types of loading have been made and much discussed by different authorities, and a comparatively recent paper on this subject by Mr. J. G. Hill summarizes arguments in favor of the two types in a very excellent manner. It is a well-known fact that the two types of cable having the same transmission efficiency may be produced, the coil-loaded cable at much less expense than the continuously loaded cable. Mr. Hill bases his comparison on two factors; one, that inductance can be added by the continuous method of loading only up to a certain limit, say 20 millihenrys, while by coil-loading any desired amount of inductance may be added to the circuit; and second, that the ratio R/L, obtainable with the coil-loaded cable, is much less than that obtained in continuous loading. The limit of economic loading depends upon the amount of resistance added to the circuit in increasing its inductance.

The attenuation constant of a cable is unfavorably affected by the addition of resistance. All known methods of increasing the inductance of a circuit also increase the effective ohmic resistance, and Mr. Hill compares the efficiency of the added inductance in terms of the amount of resistance so added. It has been found that the ratio between the added resistance and the added inductance for continuous loading is about 110, while a good design for loading coil has a ratio of R/L of about 60. These ratios are true only for the amount of inductance used in ordinary practice. The increase in effective resistance, as is well known, is due to the eddy currents and hysteresis losses in the iron of the magnetic circuit. Eddy current losses can be reduced by subdividing the iron. Hysteresis losses depend upon the degree of saturation of the magnetic field, which is kept low in all telephone circuits. Pupin coils employ a toroidal magnetic core composed of a large number of turns of very fine iron wire with some type of enamel insulation. It is possible to employ several layers of fine wire on a continuously loaded cable, and several have been laid which use three layers. The improvement in the magnetic circuit by such subdividing is not so marked as in the coils, and the expense is very much greater. It would seem that future design will show a still greater advantage in the coil-loaded type of cable, as it is probable that the R/L for loading coils can be reduced still more, economically. It might be of theoretical interest to remark that as the effective resistance of a coil-loaded conductor is a function of the frequency, it is therefore impossible to build a distortionless circuit employing iron magnetic fields.

We can therefore summarize the arguments that we considered in selecting the type of cable as follows:

Arguments in Favor of a Coil-Loaded Cable. 1. Could employ smaller conductors and less gutta-percha, and secure a cheaper cable for the same transmission equivalent (disregarding terminal losses).

2. Could give the phantom circuit the same degree of loading as the physical circuits.

3. Could add any desired amount of inductance.

4. Ageing of the iron cores of the loading coils could not unbalance the circuits.

Arguments in Favor of a Continuously Loaded Cable. 1. Simplicity of construction.

2. Could be laid and repaired like an ordinary gutta-percha insulated telegraph cable.

3. Short lengths added in repairs do not materially affect the transmission.

4. Not liable to faults at loading coils.

5. Faults could be located more accurately by means of resistance measurements.

6. Is not heavily loaded, and therefore has less reflection losses at shore ends where it joins to non-loaded open wire lines, than would be the case with a coil-loaded cable.

7. Known to be reliable at the greatest depth of water.

It was after due consideration of the above factors that the continuously loaded type was decided upon, and the results obtained have amply justified the selection.

"CAMP CO-OPERATION."

At the invitation of the Association Island Corporation, over one hundred and fifty guests, composed of representative men in the electrical industry and others not directly connected with the electrical business were invited to spend three days during the first week in September at "Camp Co-Operation." Association Island, located in Lake Ontario near Sackets Harbor, New York, has been used as a conference headquarters for some time by the manufacturers of incandescent lamps. The gathering was representative and the purpose of the meeting was to promote a closer co-operation among the various branches of the electrical industry and to discuss questions important to immediate future development.

The meeting was entertained on Wednesday evening in opening with motion pictures. the films for which were selected by Thomas A. Edison who was unable to attend the meeting in person. The pictures were illustrative of the idea upon which Mr. Edison is now working to turn motion pictures to educational uses. For instance, one film was, in itself, a course in elementary electricity and magnetism while another was a biological study of moth development.

Samuel Insull spoke briefly of his early association with Mr. Edison at Menlo Park and touched on the early cost of manufacturing incandescent lamps, a cost analysis for one month in 1883 showed that the expense of making each lamp was from $1.50 to $1.75, the retail sales price being 35 cents.

The session was formally opened by S. O. Richardson Jr., general manager of the Libbey Glass Company, and president of the Manufacturers' Club. Mr. Richardson welcomed the guests to "Camp Co-Operation" in behalf of the Association Island Corporation, and A. W. Burchard, vice-president of the General Electric Company, followed with a brief history of Association Island and explanation of the use made of it as a conference headquarters.

Joseph B. McCall, president of the National Electric Light Association, was chosen as presiding officer. As chairman of the meeting, he called on Samuel Insull, president of the Commonwealth Edison Company, for the first paper of the evening.

Mr. Insull, spoke on the "Distribution of Electrical Energy, Present and Future," tracing the development of the central station business and showing that the progress of electrical transmission is fully as important as transportation in the commercial advancement of a nation. The business of the central station has changed in the last few years from a lighting business to a power business. The central station which has merely a normal power business has only a load factor, at best, of approximately 30 per cent, while the central stations which have developed their power load energetically have raised their load factor to about 45 per cent. Only 25 per cent of the output of the Commonwealth Edison Company of Chicago is consumed in lighting load and while this company has more lighting customers than any other central station in the world it derives 47 per cent of its total income therefrom. In speaking of the future Mr. Insull said that the immense capacity generating units now available and the necessity for fuel conservation, made it certain that the production of electric energy would become concentrated.

Senator Willard Howland of Massachusetts delivered an address on "Government in Relation to Business." Senator Howland, who is also chairman of the Massachusetts State Commission of Conciliation and Arbitration, brought out particularly the fact that public utilities which were being operated with a view to giving the public the best service at a fair remuneration for the capital employed have nothing to fear from government ownership.

In the evening, Dr. Chas. P. Steinmetz spoke on "The Future Technical Development of the Electrical Business." He stated that it was only possible to judge the future from the present trend of the industry. We have at present 30,000 h.p. generators and it is evident that more economical production of energy will be possible with still larger units. It is certain that larger units will be built as soon as the demand requires. We now have electrical transmission at 140,000 volts for a distance of 200 miles covering from 10,000 to 20,000 square miles, so that the interlinking of great transmission systems is decidedly possible for the future.

The Mazda lamp of today gives five times the light of the first lamps manufactured by Mr. Edison for an equal current consumption and still greater advances along these lines are already forseen. The recent developments in electrometallurgy and in the domestic electric utensils give promise for the future. In closing, Dr. Steinmetz said: "The fact that electrical energy cannot be economically stored means that it must be consumed at the rate at which it is produced; it means that economy requires co-operation; consolidation in a big, nation-wide energy generating, transmission and distribution system analogous to our present railway system."

Hon. John H. Roemer, chairman of the railroad commission of Wisconsin, spoke on "State Commission Control." Mr. Roemer laid stress on the necessity for intelligent regulation of all public utilities. Both the utility corporation and the public have rights in which they should be able to expect protection. A great deal of trouble has arisen over the question of franchises. Unless a franchise is granted for a long period, there is little inducement for the investment of capital. It is almost impossible to clearly define the duties and restrictions which should govern a public utility corporation over a long period of time because of the changes time necessarily brings about.

The only solution which seems practicable is the granting of indeterminate franchises which may be revoked at any time provided the community pays what a fairminded tribunal shall determine to be the correct value of the property. The system of commission control removes the necessity for the utility to be a factor in local politics, does away with discrimination in rate schedules and prevents law suits and unnecessary duplication of machinery and material which the public must pay for when there is unnecessary competition between rival utility corporations. The Wisconsin commission particularly, has rendered valuable service in establishing uniform systems of accounting, inspection of equipment and settlement of rate disputes.

The next morning Mr. Frank Vanderlip, president of the National City Bank of New York, spoke on "The Financial Outlook." Quoting from his opening remarks "Four hundred millions a year, eight millions a week, of fresh capital can profitably be used in the development of the whole broad field of electrical industry in the United States during the next five years. What the calls for new capital might reasonably be expected to reach after five years, no one can predict with accuracy, but I believe that it is a conservative estimate to say that the intelligent development of the industry as a whole could absorb four hundred million dollars per annum for the next five years, if that amount were available for the purpose."

Mr. Vanderlip said that only one or perhaps two out of ten investors were at present willing to invest in public utilities. They do not yet trust the stability of the business and fear the present political tendencies. It is the duty of the bankers of the country to educate investors as to the certainty of a steady, fair return on capital which these utilities offer.

Mr. F. D. Fish, one of the foremost patent attorneys of the times, discussed "The Principles of Resale Control," reviewing the history of the disposal of commodities by the maker to the public. Less than a generation ago, every inducement was made to manufacturers and transportation companies by the community in order to increase the commercial activity of the country. From this public feeling, and the laws which followed it immense commercial enterprises have grown and with them immense fortunes in the hands of a few men. Public sentiment has changed and is now unfavorable to these very things which were the outgrowth of public opinion. Competition has become so keen that it is destructive and has forced manufacturers of similar commodities to combine and to agree on certain prices. The fixed re-sale price is the manufacturers defense against the cutting of retail prices.

Dr. Steinmetz made a very interesting comment on this paper, stating that the fixing of the re-sale price of a commodity eliminated competition, which elimination, contrary to popular opinion, is desirable because competition has ceased to be a progressive force in business and has become a destructive force instead. Dr. Steinmetz stated that "competition died on the day on which the advance of engineering had increased the means of production of a commodity beyond the maximum amount which could be consumed under the existing social conditions. Unlimited competition forces prices down not to the value of giving a fair profit above the cost of production but the dropping of price stops only where the loss in production exceeds the loss of having the industry stand idle."

J. Robert Crouse, read a paper regarding "The Society for Electric Development." Mr. Crouse outlined the wonderful progress which the electrical industry has seen in research and inventive development and compared it with the lack of progress in selling methods. The ratio of sales expense to the amount of sales is at present tending towards an increase instead of decreasing as it should.

Mr. J. M. Wakeman, general manager of the Society for Electrical Development, outlined the plans of the society.

Henry L. Doherty, president, Society for Electrical Development stated that the membership had reached four hundred and that $135,000 of the $200,000 required by the Society has already been subscribed.

Dr. Thomas Darlington, secretary of the welfare committee of the Iron and Steel Institute of New York, outlined the welfare work which is not being done by a great many corporations. Money spent in welfare work has been found to be a paying investment because of the better quality and greater quantity of work which results.

Frank W. Smith, vice-president, Electric Vehicle Association of America, spoke of the co-operative advertising campaign that society is now running for which $42,000 has already been spent and for which $34,000 is pledged for next year. Of the $42,000, fifty-eight per cent was contributed by central stations, 31 per cent by manufacturers of accessories and 11 per cent by vehicle manufacturers.

Norman Macbeth, vice-president, Illumination Engineering Society, pointed out the co-operative organization of the Illuminating Engineering Society. Less than one per cent of its members are actually professional illuminating engineers; electrical engineers, gas engineers, architects and designers of fixtures and glassware being numbered among its membership. This society is at present accomplishing much good through co-operation with other societies and educational organizations.

Mr. S. O. Richardson Jr. spoke for the Manufacturers' Club which was organized to give their members a broader understanding of patent laws, standardization of materials, welfare work, etc. The Manufacturers' Club is heartily in favor of the Society for Electrical Development because it offers a cheaper and better method of advertising.

Electrical washing machines are used by 25 per cent of the customers of the Pacific Light & Power Company in Pomeroy, Wash.

Water powers with an aggregate estimated capacity of 12,000,000 h.p. are available within the national forests for use under permit from the secretary of agriculture.

Erection of ornamental standards by use of the city steam roller has been economically accomplished by City Electrician Toal of Ely, Minn., who converted the steam roller into a lifting crane.

ELECTRICAL PUMPING AND IRRIGATION

THE SELECTION AND INSTALLATION OF A SMALL PUMPING PLANT.

BY B. A. ETCHEVERRY.

[Continued.]

First Cost of Plant.

The first cost of a pumping plant depends on the grade of machinery, the cost of transportation, the expense of installation. Because of these factors accurate estimates of cost cannot be given. However, the approximate cost values given below will be of value to the land owner who is considering the feasibility of a pumping plant. The values given represent the prices at the factory and do not include transportation and installation.

Approximate Cost of Single Stage Centrifugal Pumps.

No. of pump.	Capacity in gal. per min.	Cost.
2	100	$ 42
2½	150	51
3	225	57
3½	300	65
4	400	75
5	700	85
6	900	115
7	1200	145
8	1600	170

The cost of two-step centrifugal pumps of the same size will be about four times the values given above.

Approximate Cost of Triplex Single-Acting Power Pump.

Dia. of water cylinder. In.	Length of Stroke. In.	Capacity in gallons per min.	Height of Lift. Ft.	Cost.
4	8	65	75 to 100	$170
5	10	130	100	250
6	12	220	100	340
4	6	48	175	225
5	8	91	175	325
7	8	180	175	450
8	10	270	175	700
8	12	310	175	750

Approximate Cost of Electric Motors, Gasoline Engines and Simple Slide Valve, Non-Condensing Steam Engines, With Locomotive Boiler and Auxiliaries.

Horsepower.	Cost of electric motors, 1200 rev. per min.	Cost of gasoline engines.	Cost of steam engines.
2	$ 70		
3	85		
5	110	$375	$500
10	200	550	625
15	230	700	800
20	320	850	925
25	360	1000	1000
30		1200	1200
40	450	1600	1350

The above costs are for the pumps and engine, and do not include the accessories, the foundation, the labor or installation, and the housing. For an electric plant the cost of transformers should be added unless these are supplied by the electric company. The accessories will include the suction and discharge pipes, the valves and fittings, the priming pump, the connection between pump and engine. The suction pipe is usually made of steel; the discharge pipe may be steel or wood banded pipe and should cost delivered as follows:

Cost of Pipes Safe for 150 Ft. Head.

Diameter of Pipe. In.	Cost per Ft. Wood Banded Pipe.	Cost per Ft. Steel Pipe.
4	$ .20	$ .30
6	.30	.50
8	.40	.80
10	.55	1.10
12	.65	1.35
14	.75	1.60
16	.95	2.00
18	1.10	2.50
20	1.44	3.00

For a rough estimate the total cost of valves, priming pump, all fittings and suction pipe, but not discharge pipe may be taken as about 10 per cent of the cost of pump and engine for a gasoline or steam plant and 20 per cent for an electric plant. The cost of installation should not exceed 5 per cent. The cost of a building to house the plant will range from about $25 for a small plant to $100 or more for a larger plant. The cost of transportation and hauling will depend on the railway charge and on the distance from the station to point of installation.

Fuel Consumption and Fuel Cost.

The selection between a steam engine, gasoline engine and an electric motor will depend to some extent on the comparative cost of coal, gasoline and electrical energy.

A gasoline engine is usually guaranteed for a fuel consumption of 1/8 of a gallon per rated or brake horsepower per hour. A new engine well adjusted will come up to this efficiency, but an engine that has been operated some time will consume about 1/6 of a gallon of engine gasoline or distillate per brake horsepower per hour.

The fuel consumption of a steam engine will vary greatly on the type of boiler and engine. A small slide valve non-condensing engine under 25 h.p. will use probably 50 to 60 pounds of steam per brake horsepower per hour. A locomotive type of boiler should give 5 or 6 pounds of steam for 1 pound of coal or about .6 pounds of oil. Therefore, a small steam engine under 25 h.p. should consume about 10 pounds of coal per brake horsepower per hour or about 6 pounds of oil. Steam engines of the same type from 30 to 50 h.p. will consume from 8 to 5 pounds of coal per brake horsepower per hour or from 5 to 3 pounds of oil.

Electrical energy is measured in kilowatts. A kilowatt is equal to one and one-third horsepower, but because of the loss of energy in the motor, 1 kw. will usually give about 1.1 brake horsepower. Based on this figure 1 brake horsepower is equal to .9 of a kilowatt hour.

The above values show that to produce 1 brake horsepower per hour requires either 1/6 of a gallon of distillate, about 10 pounds of coal, or 6 pounds of oil for a kilowatt hour. Based on these figures the table below shows the cost of fuel per brake horsepower per hour for several equivalent cost values of fuel. In the table is also given the fuel cost of pumping one acre foot of water through one foot of lift, assuming plant efficiency of 50 per cent and 75 per cent.

Cost of Fuel per Brake Horsepower per Hour.

Equivalent unit costs of fuel.				Fuel cost (in cents).		
Cost of gasoline in cents per gal.	Cost of crude oil per bbl. (335 lb.) in dollars.	Cost of coal per ton in dollars.	Cost of electric per kw.h. in cents.	Per brake h.p. per hour in cents.	Per acre ft. of water lifted 1 ft. high. 50% efficiency.	75% efficiency.
6	$ .55	$2.00		1.00	2.75	1.83
8	.75	2.66		1.33	3.70	2.45
10	.93	3.33	1.85	1.66	4.60	3.05
12	1.12	4.00	2.22	2.00	5.50	3.65
14	1.30	4.66	2.60	2.33	6.40	4.25
16	1.50	5.33	3.00	2.66	7.30	4.90
18	1.67	6.00	3.33	3.00	8.25	5.50
20	1.85	6.66	3.70	3.33	9.15	6.10
22	2.05	7.33	4.10	3.66	10.10	6.70
24	2.25	8.00	4.35	4.00	11.00	7.35
26	2.42	8.66	4.80	4.33	11.80	7.95

Fixed Charges and Attendance.

A. Fixed charges.—The cost of installation represents a capital which if invested would bring in an income represented by the interest. It is therefore necessary to consider this interest as part of the cost of operation. To this should be added the annual cost of repairs, maintenance and renewal. These items of cost represent the fixed charges. After 6 or 8 years a gasoline engine may need to have its cylinder rebored and a new piston provided, the cost of which is about one-fourth the cost of a new engine. With ordinary care the life of a gasoline engine may be taken as 10 years; the life of an electric motor about 15 to 20 years. The fixed charges on the entire plant may be taken as follows:

Fixed Charges.

	Gasoline engine Plant.	Electric Plant.	Steam Engine Plant. (Small).
Depreciation and renewal	8%	5%	8%
Repairs and maintenance	3%	1%	2%
Interest	6%	6%	6%
	17%	12%	16%

B. Attendance.—An electric motor requires a minimum of attendance, small gasoline plants require frequent inspection, and steam engines require considerable attention and usually cannot be economically used for small plants operated during short periods. The cost of attendance for an electric motor pumping plant should not exceed 5 cents per hour, for a gasoline engine plant 10 cents per hour, and for a steam engine plant 30 cents per hour. While electric motors and gasoline engines are usually operated by the orchardist or irrigator, his time is valuable and a charge should be made for it.

[To be continued.]

Safety at sea.—Secretary of Commerce Redfield's Committee on Aids and Perils to Navigation to prepare recommendations for the use of the American delegation to the London International Conference on Safety at Sea has made its report, recommending among other things, that all ocean-going steamers, equipped with electricity, shall carry a searchlight so placed as to illumine all points of the horizon as far as practicable, and of sufficient power to distinguish a ship's 20-foot boat at a distance of not less than 1 nautical mile on a clear dark night. That all light vessels on important outside stations shall be equipped with submarine bells, and all ocean-going vessels shall be provided with means for detecting submarine bell signals. The committee recommends that the international rules of the road be modified so that carrying of range lights shall be obligatory instead of optional, as at present, and that all vessels shall carry a fixed stern light.

The application of radiotelegraphy to the collection of weather reports from oceanic areas gives promise of securing to navigators a greater measure of safety from the perils of the sea than has hitherto been possible. Such a service necessarily would be international in character, the expense of which should be shared jointly by the nations most directly concerned. The committee recommends, in the interests of the future development of radio-meteorological services, that the existing meteorological service of each administration adopt as part of its program the organization of a radio service for the coastal waters pertaining to that administration.

PUBLIC SERVICE RATE-MAKING.

BY ALEX C. HUMPHREYS, M.E., Sc.D., LL.D.

(Although actually a discussion of a previous paper on the determination of gas rates, a consideration of the viewpoint presented by Dr. Humphreys should prove of interest to all public utilities. This paper was read before the Pacific Coast Gas Association convention, 1913, and the discussion is also included.—The Editor.)

In choosing the subject for this paper I have had in mind the definite purpose of discussing the paper by C. L. Cory, entitled, "Reasonable Gas Rates and Their Determination," presented at the 1912 meeting of this association.

While I find in Mr. Cory's paper some grounds for agreement with him, I find other grounds for material disagreement. Much of what I shall have to say will also be applicable to public service other than that of gas supply.

In accepting Mr. Cory's statement that the "storage of gas in large gasholders * * * eliminates, to a considerable extent, the necessity of providing a manufacturing plant proportional to the maximum demand, as must be done in most electrical generating stations," we must keep in mind that he is referring to the hourly maximum demand. In this particular the gas plant has a marked advantage over the electric light plant. But in connection with what is to follow, we should bear in mind that it is not good practice to design or even depend upon a gas manufacturing plant which has a capacity less than the maximum daily demand. In fact, in designing such a plant we should expect to provide a capacity considerably in excess of the expected present maximum daily output. Certainly, if our maximum daily output has reached the safe manufacturing capacity, no time is to be lost in adding to that capacity.

Under certain circumstances it may become necessary "to install an automatic pressure regulator for each customer," but it by no means follows that this will obviate complaints or prevent "variation of pressure at the gas consuming devices." Especially in high buildings and where the governor is installed in the basement there is full opportunity for variation in pressure after the gas has passed the governor. The governor also adds one more mechanism to be kept in order, and frequently is the breeder of complaints.

Unquestionably, the best possible service should be given to the customers. It does not follow, however, that the service given is faulty or inadequate because complaints are made. Every complaint should be investigated and faults should be corrected promptly and completely, and employes who repeatedly fail in this regard should not be retained in service; but this will not completely eliminate the complainer. As long as trade exists between human beings, there will be both cause for complaint and complaint without cause.

I am sorry to get the intimation through Mr. Cory's paper that there are gas managers on the Pacific

Coast who are still treating their customers so brutally as to warrant their subjection to such tortures in Hades as Mr. Cory so graphically describes. It may be that "The wide variation in gas rates in the different cities of the Pacific Coast" is at least in part due to the men who are past due in "the bottomless pit of Hades."

Control of public utilities by public service commissions is a fact and we must make the best of it. A fair and able commission operating under a fair law may perform a great service for the public utilities and those they serve. But let us not use as one of the arguments in favor of public service commission control that we thus avoid "The so-called regulation of rates and service directly by inexperienced though well-intentioned (?) municipal or county (or state) officials elected by the people." Whatever may be the fact on the Pacific Coast, public service commission control has not in the East eliminated "strike" legislation.

While speaking of regulation by public service commissions, let me say that their powers should not include the three functions of government which should be kept separate and distinct according to our American ideals and traditions—namely, the legislative, the executive and the judicial. In some cases the commissions have exercised all three of these functions, and this must be corrected if our form of government is to be maintained.

I am glad that Mr. Cory has quoted from the sane report of the railroad securities commission, of which President Hadley was chairman. It is a pity we cannot get more of this kind of advice to place before our legislators.

I am glad to agree completely with Mr. Cory in his statements as to the risks accepted by those who engage in public service enterprises. This is something which is almost, if not completely, ignored by the man in the streets, and we are today largely governed by that man. Mr. Cory's enumeration of some of the hazards to which public utilities are subject is most timely. I would not, however, confine the risks to the smaller companies. I am moved also to add at least one item to the list: the cost of defending actions against the utilities in courts and before commissions.

I must confess I have not noticed to any great extent that "the tendency of public service commissions and of courts has been towards allowing higher rates of return than were at first regarded as sufficient for a public utility to earn." From this statement I presume our friends on the Pacific Coast are to be congratulated.

I think that Mr. Cory's warning against the use of the term "deficit" in connection with "development expense," is most apt and timely. The questions involved in "going value" as separate from the other elements of value in a going concern, are, at the best, complex and difficult of complete explanation. Certainly our difficulties should not be magnified by the use of misleading terms—a fault which is much in evidence in this day of "reform."

Having cleared the ground for a concrete example, Mr. Cory says, "I have compiled some data and figures upon a gas plant and system which I will say frankly has no physical existence so far as I know." The following pages, however, treat the questions involved as if it there were a specific gas property under analysis. For instance, page 21: "From 1905 to 1912, records were available so that these curves could be compiled." Were the records of an imaginary plant available or does Mr. Cory refer to the average of a number of records? Then follows a curve diagram which is explained and interpreted in detail as if based upon facts. For instance: "On June 30, 1907, there was very little difference in the number of services, meters, and consumers respectively, but two years later there were many idle services and meters, which again is not a good business situation for a gas company." I confess I am unable to understand what we are considering. Is it data that can be supported or is it guessing?

But let us consider some of the data or assumptions included after the title: "Practical Illustration in the Determination of Gas Rates."

The unaccounted for gas ("Leakage") is taken as 11,000,000 cu. ft. or about 300,000 cu. ft. per mile, not reduced to uniform size of pipe. The 15.5 per cent indicates a high "leakage," but of course this is not conclusive. The 300,000 cu. ft. per mile is conclusive to the effect that the unaccounted-for is far higher than represents good average practice.

It is stated that because of the locality a higher rate of return is rightfully to be demanded than if the plant were located in the East, and then 8 per cent is taken as the fair rate of return. Certainly not less than 8 per cent should be demanded in the East.

The "going value"—apparently here assumed to be the cost of developing the business and not the total value as a going concern—is assumed to be only "about 10 per cent of the total value." This is an extremely low estimate and one which it would be most unsafe to follow in the great majority of cases.

Having assumed that the output is 71,000,000 cu. ft. per year and the sales 60,000,000 cu. ft., the cost, including depreciation, plus return of 8 per cent, is taken as $1.40 per thousand cu. ft. It is then stated that it is not proper to conclude that the proper rate to be charged is $1.40 per thousand, but the sales should be increased to 84,000,000 cu. ft., the cost plus return on investment to remain as before; namely, $84,145. This indefensible assumption is vital to the author's main proposition.

The author has already shown that there is a cost for the taking on of customers, though he sets this cost at the low figure of 10 per cent of the total value, or say $36,250, or about $13 per consumer. Will it cost nothing to secure the additional consumers and to induce those already on the books to increase their sales? Allowing fully for the fact that the expenses will not increase directly with the increase in output, will it cost nothing to manufacture and distribute the additional 24,000,000 cu. ft.? Is it at all likely that this increase can be obtained without creating a demand beyond the established system of mains, and will the additional mains cost nothing? Unless all the increase is to come from increase in sales to the present consumers, will the additional services and meters cost nothing?

But beyond all these considerations, which need only to be mentioned to negative Mr. Cory's proposition, there is an assumption which is most fallacious. Apparently the author assumes that the manufactur-

ing plan and distributing system have surplus capacity, and that this surplus capacity can be utilized for increasing the sales without additions to the plant. As to mains, services, and meters, I have already raised the question whether the sales could be increased 40 per cent without taking on new consumers. Now as to the manufacturing plant:

The manufacturing capacity should be based upon the maximum day's output, with a liberal margin for emergencies and increases. Certainly no engineer or manager would for a moment contemplate deferring his extensions until the maximum daily demand had reached or nearly reached the manufacturing capacity. This means, then, that unless there is an excessive surplus of manufacturing capacity, the increase in sales, as a general proposition, requires an increase in investment for manufacturing. We may, perhaps, be able safely to utilize a portion of our excess capacity, but when the time comes to extend, we must extend to cover the margin of capacity as before. In other words, it would not be practicable or economical to increase our manufacturing capacity year by year to meet exactly the yearly increase in output, so we have to make these extensions to cover the increase of a number of years. But this by no means implies that any one or two or three years can have the benefit of their proportion of the excess capacity without paying for it. If this were legitimate accountancy we might with equal force say that the years should not carry their share of the accrued and accruing liability for final renewals—generally known, and unfortunately so, as "depreciation." When our increased sales are absorbing our surplus manufacturing capacity, we are making a temporary gain on investment return; when we come to the time for extending the plant, we experience a corresponding additional burden on investment return. To spread this burden equally, then, we disregard the temporary advantage which Mr. Cory's presentation of the case indicates as a permanent advantage.

Looking back over my experience of many years, including operations, investigations and hearings, I can think of no statement more dangerous and misleading than the one now under discussion—namely, that the sales can be increased 40 per cent "without materially increasing the investment required." Even if this claim had been proved or were demonstratable, nothing is said by the author about the increase in operating expense, as previously referred to. For instance, the amount of oil used would increase directly, and so this item would increase from $14,300 to $20,020.

Near the end of his paper, Mr. Cory says: "The fixed charges in the manufacture of gas bears such an important relation to the total cost of manufacture that increasing the amount of gas made in a single plant very materially reduces the total cost of the gas delivered to the holder." It cannot be that Mr. Cory really means that by increasing the amount of gas manufactured and delivered "the total cost" is lessened. We may presume that he means that the cost per thousand would be reduced. But even if we give him the benefit of this doubt, it is apparent that he has fallen into error; an error all too prevalent with those partly informed. If, for instance, a comparison of costs were made as to two companies operating under conditions as nearly similar as possible, one selling 60,000,000 cu. ft. a year and the other company selling 84,000,000 cu. ft. a year, the difference in cost per thousand would be found hardly to deserve the designation "material."

We now come to a point which should be considered in all rate-making investigation—namely, that the carrying of each customer on the books of the company is a continuing expense to the company, independent of the amount of gas sold to and paid for by the customer. A large proportion of the gas customers carried on the books of the gas companies of the United States are a source of final loss to the companies. In other words, the profit on the gas so sold is not sufficient to offset the fixed losses referred to. This fact is well recognized by all who have given the matter competent study, and this has been recognized in many papers which have been read before our gas association. Further, it has been recognized in gas rate schedules put into force, and still more often in electric light and power rate schedules. This condition was met in a rough way by the charge formerly made for meter rent. But the term became obnoxious and so the charge was eliminated by legislation, notwithstanding its fundamental justice.

The fact that each gas customer places an item of operating cost upon the gas company should alone have prevented Mr. Cory from assuming that the gas sales could be increased 40 per cent without adding to the total of operating cost.

One of the most important features in rate-making cases before commissions and courts is referred to in a very few words in Mr. Cory's paper—namely, the determination of the present value of the property as a whole. Generally, the rule followed has been the cost to reproduce, and in many cases it has been contended by the parties opposed to the public utilities that from this cost to reproduce new there should be deduced the accrued "depreciation." Further, it has been contended that this "depreciation" should be estimated on the basis of the "average life" of the plant and the age as found of the several parts of the plant. Further, it has often been claimed that the "average life" should be determined by reference to life tables based upon averages.

Not only have the commissions and courts been inclined to accept this claim, but too often the representatives of the companies have failed to oppose this claim adequately.

The question of "depreciation" is far too large a subject to cover in this paper; to do so would tax the patience of this audience. For the 50th anniversary of the Institution of Gas Engineers of Great Britain, held in London last June, I prepared a paper on this subject and I now quote the abstract of this paper and I attach hereto as an appendix the complete paper. The abstract is as follows:

"Depreciation"—Estimated and Actual.

This paper, lengthy as it is, does not pretend to answer exhaustively the complex questions involved.

An abstract, then, can do little more than develop the questions and suggest the answers.

Much that is contained in the paper has particular reference to conditions found in the United States; not a little is of general interest and application.

First, it is necessary to differentiate between estimated "depreciation" to accrue, to be included in the annual statements of operating expense, and actual "depreciation" as found by present appraisal.

It is also to be borne in mind that the term "depreciation" is a term often loosely employed.

It might be better if the expenditures to compensate for "depreciation" were classified and described as repairs, current renewals, and final renewals. When the first two are charged against current income as paid, estimated "depreciation" might better be known as final renewals.

This last item is of interest only in connection with the purpose to determine and set out the true and full annual operating expense, which should include all liabilities chargeable against the year's operating expense.

The necessity for such an estimate and charge is modified or eliminated when the charges for final renewals, as represented by the yearly expenditures, are found to be fairly uniform.

This means that the estimates on "depreciation" to accrue is made for the purpose of spreading as uniformly as possible over the life of the several parts of plant the cost of their renewals.

This is desirable from the accountancy and financial standpoints so that the profits may be shown as accurately as possible, that the returns on capital may not be inflated, and that the capital may be safeguarded.

It must be constantly borne in mind that this annual charge is based upon an estimate, and that the basis for the charge should be subject, year by year, to correction as experience, general and local, is gained.

In estimating "depreciation" to accrue, account should be taken of the following three elements: Physical decay, obsolescence, and inadequacy.

Actual "depreciation" should not be determined or estimated by the test of tables of average life and ascertained age of plant; but by expert examination of the plant as it stands, taking account of physical decay, obsolescence, and inadequacy.

An estimate made in advance, and especially when based upon averages, should have little standing in face of the facts as they exist.

Actual "depreciation" is to be considered from two standpoints:

It is to be assumed that the plant is maintained in a condition of high service efficiency. The case of a broken down or inefficient plant is not under consideration.

In any case, the "depreciation," or accrued cost of final renewal, should be treated as a liability resting upon the owners.

Hence, in a rate-making case, the public service corporation being under the control of governmental authority, estimated or appraised "depreciation" should not be deducted from the appraised cost to reproduce new. The public service corporation is under obligation to renew the parts of plant as required to maintain efficiency of service. The quality of service is the test.

If "depreciation," in such a case, is deducted, the result is that year by year to the end of the so-called "average-life" the appraised value of the plant, based upon cost to reproduce, is reduced until the value vanishes just before the end of the "average life." In this case there would be no investment in plant on which to claim a "fair return." An absurdity on its face.

This contention in no way conflicts with the proposition that, in case of purchase and sale of the property, allowance should be made for "depreciation." In this case the deduction is made in favor of the purchaser and the purchaser in turn assumes the liability for the cost of final renewals.

Many other points are incidentally covered in the paper. One is—the question as to the right of the owners to include in the plant appraisal the cost of pavements laid subsequent to the installation of mains and services. A decision of the appellate division of the supreme court of New York, rendered since the writing of this paper, supports the claim that the public service corporation has the right to include this cost in the appraisal of plant, notwithstanding the fact that the pavement cost was met by the municipality. This decision also supports the claim for "Going value.". (End of Abstract.)

Mr. Cory appears to hold that unless a depreciation fund is established, a deduction should be made from the reproduction cost, and the return should be based upon this reduced property value. As I have said, this agrees with the present views of too many engineers and with many commissions and court decisions. And yet I hold to the contrary.

In the first part of his paper Mr. Cory has laid stress on the quality of service. He has shown that this service efficiency should be required of the public utilities and that the regulating authority should enforce this demand. This being the case, and the public utilities being held liable for the accrued cost of final renewals, no deduction for accrued "depreciation" should be demanded or allowed, so long as the efficiency of the plant is maintained as evidenced in the quality of the service. The cost of repairs, current renewals, and final renewals ("Depreciation") all are to be included in the operating cost, and so long as these items are not recapitalized, there is no valid claim for deduction from the cost to reproduce.

In conclusion let me summarize the items which should enter into an appraisal of a gas property.

Valuation of Property and Business.

As of (date).

(a) Preliminary development, including legal expenses, preliminary canvassing, preliminary engineering, investigating real estate values, financial reports, preparation and other expenses of prospectus and incidentals; also permanent organization during construction, including salaries of officers, clerks, timekeepers, superintendents, inspectors, etc., rent, telephone, legal expenses and all other administrative charges, with interest.......$

(b) Real estate without improvements ....

(c) Interest on item (b) at rate of (?) per cent for the full period of (?) years during construction......
The real estate would necessarily be purchased in advance of the construction period.

(d) Construction and equipment of works and distribution system as per detailed estimate...........

(e) General contractor's compensation, including his expense and profit, (?) per cent on item (d)......

(f) Engineering (?) per cent on items (d) and (e) covering plans in detail, general engineering oversight and inspection, including organization of engineering department ....

(g) Casualty and fire insurance (?) per cent on item (d) ....

(h) Taxes during construction period ....

(k) Interest during construction period of (?) years at rate of (?) per cent on one-half the sum of items (d), (e), (f), (g) and (h) ....

(l) Stores, supplies and working capital ....

(m) Cost of developing business at (?) per dollar of income on basis of estimated income from gas sales during year beginning (date), amounting to (?) ....

Total value of property and business, not including financing or franchise ....$

(n) Financing on (?) per cent basis ....

Total value of property and business not including franchise or easements ....$

Discussion.

President Vance—Gentlemen, you have heard the very excellent paper prepared by Doctor Humphreys of New York. I am going to ask Professor Cory to open the discussion of the paper.

Professor Cory—I am grateful for the frank approval as well as the straightforward criticism of Dr. Humphreys upon the matters pertaining to the valuation and control of the public utilities which I know has interested all of us, and to which I have given quite a little attention as a member of this association during the past two years.

In considering Dr. Humphreys' paper and his analysis of the paper persented before this association a year ago by myself, I feel that I am not unlike a Japanese boy who was employed in the Cory household for a number of years. At one time while away upon a vacation the care of things at home was left in the hands of this Japanese. Among other things placed in his charge was a pet horse, the proper feeding and care of which was of some concern to the family.

This Oriental was especially a student of English and English literature; in fact he had not a little ability in speaking as well as writing English, and letters that he wrote us while on our vacation were constantly a source of much interest. One of my friends during our absence had a habit of calling around to see how things were, and in telling us of the visit of this gentleman in one letter the Japanese boy said:

"Mr. ——— came the other day and said that 'Babe' was in very good condition, that she was not being fed too much, although she needed a little more exercise, But"; and then the Jap stopped and between hyphens made this rather classic statement: "I have studied the English language sufficiently to fully appreciate that the English word 'BUT' is destined to play an important part in introducing disagreeable thought."

Dr. Humphreys' work and his writings for many years have been of such constructive value as to make us all the more appreciate his paper written for this association. I am indeed glad to find that in any presentation of this subject by myself as a member of this association Dr. Humphreys has found something of sufficient merit for his fuller discussion.

I have but a few words to say in connection with some of the points he has brought out. I fully agree with Dr. Humphreys that the regulation of public utilities by what he has called "strike" legislation is most unfortunate. In my paper I may have exaggerated the inability of many municipal officers to cope with the rate fixing problems, but I do not hesitate to say that I have no use whatsoever for any representatives of the people, I care not who they may be, who feel that it is possible for a single commission or group of individuals to occupy the manifold relation referred to by Dr. Humphreys wherein their investigations and decisions embrace legislative, executive and judicial action.

The government of nations, states and cities is so divided as to make such a combination impossible. To those of us who have given very careful and serious consideration to these matters and have made every effort to get the facts in the case have good reason, I think, to resent a decision or conclusion on the part of commissions or other controlling bodies that may even have a semblance of what Dr. Humphreys calls "strike" legislation.

Further, such a decision is many times merely a poor compromise rendered only because a decision of some character is considered necessary, even though proper information and facts are not available. Such decisions are not constructive, they stand but a short time, and do more harm than good.

In reference to the risk under which public utilities, whether gas or other companies, conduct their business, in my paper I did have in mind especially the hazards of the business of a small gas company. There certainly is a risk as Dr. Humphreys points out even with large companies, but I have especially been impressed, and I dare say that many of you here today have been equally interested in many instances, where a small city has been practically wiped out due to a cessation of the principal business of the community or a change in the routing of the main line of a railroad. Such risks as these do not usually menace the public utilities of a large municipality.

Dr. Humphreys questions whether the gas company referred to in my paper was a real operating company or an aggregate of assumptions upon which a considerable amount of guessing was indulged in. In my experience on the Pacific Coast I have become familiar with the details of the construction and operation of a number of gas companies, and I can assure Dr Humphreys that the particular conditions outlined in the illustration used in my paper a year ago represent real and not imaginary conditions. The particular illustration came so near representing a specific company on the Pacific Coast that in discussing the paper one gentleman frankly stated that the figures given very nearly fitted the particular company over which he had entire supervision.

No particular situation is usually duplicated in very many gas companies when we come to the discussion of the intangible asset usually called "going value." No specific case can ever be applied to another case. In a community which is growing rapidly and complete service given it is apparent that the "going value" for such a public utility will be decidedly greater than in another community that has not changed in size within a considerable period of time. "Going value" should not, in my opinion, be expressed in a per cent of the physical value. Nevertheless in this particular instance using ths ordinary methods of determining "going value," it happened to approximate 10 per cent of the physical value. On the other hand I have known of some companies where the going value might be as much as 100 per cent of the physical value, and it would be absurd to assume that the going value of one company can necessarily be applied to an entirely different company operating under different conditions.

Probably the most important criticism of Dr. Humphreys was in relation to my reference to the possibility of increased sales of gas. I am strongly

of the opinion that it is possible to increase the consumption of gas per meter installed if the quality of service and rates are maintained so as to be advantageous to the consumer. You may remember at our last convention instances were cited where, by the addition of industrial appliances, the amount of gas sold per meter was increased 50 per cent within a three months' period, and this increased consumption does not always mean that you have to increase your plant and your distribution system in proportion. You of course will have to pay for fuel in order to make the increased quantity of gas, but there are many items of cost which will not be materially increased if additional sales of gas can be made, particularly to manufacturing companies.

Dr. Humphreys' criticism is of course in order and proper if increased sales invariably result in a proportionate increased investment, but when the Ford Motor Car Company adopted gas exclusively in its manufacturing plant such increased sales by the gas company certainly did not involve an increase in the investment of the gas company in proportion to the increase in sales, and the price of gas usually will very materially affect the magnitude of the increase in the amount of gas sold per meter installed.

In my paper I of course had in mind the reduction in cost per thousand cubic feet of gas, and not a reduction in the gross cost of the gas where the amount of gas sold was materially increased. It would be ridiculous to assume any other interpretation of the matter.

It is true that, in my paper last year, I mentioned very briefly many of the matters pertaining to the making of a valuation of a public utility for the reason that a previous paper presented to the association at its convention in Oakland in 1911 gave a more complete discussion of this phase of the regulation of rates.

Depreciation has been so fully discussed by Dr. Humphreys that any contribution by him to this important matter cannot but be of great value. I certainly did not intend to convey the idea that at any time a plant may become so depreciated that it has no earning value whatsoever as long as it is capable of giving satisfactory service. I quite agree with Dr. Humphreys that unfortunately in many instances in the determination of rates an erroneous interpretation of depreciation has been applied in many cases.

As illustrating what seems to me to be the fairest attitude towards the annual depreciation as well as the depreciated value of the plant of a public service utility, let us suppose that a man builds a house which is to cost, we will say, $10,000, and agrees with a tenant that the latter is to pay a rental which will give the owner a net return after taxes, insurance, etc., are paid, of 8 per cent. The tenant certainly has no right at the end of five years to take the position that the roof of the building has but a life of ten years and therefore demands a decrease in rent because the roof has deteriorated 50 per cent. As long as the roof of the house fully serves its purpose that is all that can be required, but the owner must not forget that at the end of ten years his depreciation fund should be sufficient to put on an entirely new roof.

This illustrates the point, I think, that Dr. Humphrey is driving at, but in the past it has been extremely difficult to get some of the rate fixing boards to look upon the word "depreciation" as anything other than a "bogey" set up by the public utility managers in order to impose upon the people a higher rate for service than is justified by the investment.

The time is ripe, however, for the most careful analysis of depreciation and such an analysis has been most carefully and accurately worked out by Dr. Humphreys, and his writings can be followed without question by those desiring a proper interpretation of depreciation, particularly as applied to gas plants. It is a fine thing then that we of this association have the chance to study an abstract of his classic paper.

Finally, I wish to say that the outline or details of items which should be considered in making the valuation of a public utility gas system as presented by Dr. Humphreys should be of very great use to the members of this association. Experience particularly in these latter times fully indicates it is difficult to cover all the items of cost entering into the conception, organization, construction and operation of a great public utility, and the more data we can get the more accurately will the figures be which are used as evidence of the present value of such public utilities.

Mr. E. C. Jones—I feel that our opinions as gas men are formed by our geographical location and by our local traditions. Doctor Humphreys was brought up in the gas business where every retort had specific dimensions, receiving a certain amount of coal every five, four or three hours, and produced its given quota of gas, not more and not less. And when the introduction of water gas made gas making easier, the capacities of water gas generators were so nicely calculated that a million foot generator meant a million feet in 24 hours of production capacity. One of the traditions of the gas business in the east where I was brought up and received my early training under those hard old masters, was that a gas company in all its expected prosperity might increase its sales of gas double in ten years. Now, to get to the question. We have on the Pacific Coast a new method of making gas—oil gas. We have generators whose capacities have never been tried till quite recently. We have traditions brought about by earthquakes, fire and the rapid growth of a new country, where instead of getting a doubling of our business in ten years we have had increases of 400 per cent in five years. We have been forced within the last four months by strike conditions to greatly exceed the rated capacity of all gas generators. Now, if Doctor Humphreys could come to California and find out the conditions under which we are operating and the conditions with which Professor Cory is familiar, he would most certainly agree with Professor Cory. I am glad, gentlemen, that this paper has been so ably discussed by Professor Cory and in such a nice spirit.

President Vance—I am going to call on W. E. Barrett of Los Angeles to discuss this paper of Doctor Humphreys.

Mr. W. E. Barrett—The president seems possessed to pick on little men. Why he should pick on me I don't know. I came here a very inoffensive citizen without any intent of creating any disturbance whatever.

I suppose because President Vance thought that I had some years ago been a subordinate of Doctor Humphreys, that I might have imbibed some of his ideas. It is absolutely untrue. I have got some of his thoughts.

We are face to face with a very serious moment in the life of our public utility. In the first place we are divided between two sets of conditions. First, if we wish to spend money we must apply to the state railroad commission for authority to spend it. It is based on what we are doing today and our income today, without any sign of warning or without any consideration apparently from the purely arbitrary standpoint the local rate-fixing body, which has no dependency on the rate-fixing commission, fixes our rate of income for the next year, after we have made our expenditure, regardless of what we have done with that money and without any investigation or consideration. The result is that a rate is fixed at such an arbitrary point that we are thrown into legal controversy.

We get down to the point where we must consider the income to meet the necessary demand. The mistake of most companies that I have met for the last twenty-five years, and which I have seen from an examination of some eight hundred of the different gas companies of the United States, is that they provided no adequate depreciation or no adequate provision for replenishment of their property. The result is that we come down to the present time and we come before a rate-fixing body and we ask for what is commonly called depreciation—a very mysterious term, as Professor Cory and Doctor Humphreys have both shown. It is a very difficult matter to explain what depreciation is. The judicial body will say, "The property is maintained and kept in first class working conditions. Where do you get your depreciation?" We draw a life-line, which, as Professor Cory states, comes to a conclusion sometime; and yet we have a property complete with all its functions and we have no investment. Necessarily on the face of such a proposition it is false. We must get at it a different way, and the determination of an item of that kind, as Doctor Humphreys has stated, gives us an opportunity to get a correct way to get the income to cover those present necessities. In a case which I have just been through the procedure of the other side was to set up a life-line of the various parts of the property, carrying it out to a certain point for a number of years, estimated, naturally, at a guess, set up an annual rate upon that basis, deducting from the original estimated replacement value, an amount which they term scrap-value, which left a certain residuum. Upon this residuum the rate of income was supposed to be fixed—not upon your investment but upon perhaps 80 to 85 per cent of your investment, upon which you were to be allowed a return. That is manifestly absurd. You would never be able to recover 100 per cent of your property. It is physically impossible to start on an 80 per cent basis and recover a hundred per cent when you have only 80 to start with.

Furthermore, in considering as an additional portion of the total property what some are pleased to call a going value, which covers a multitude of sins in the early history of most companies, and which has been undertaken to be capitalized many times, we also run against the difficulty from the financial end of the situation which we always at all times have to recognize. With the man who has money invested in the property, the return on the investment is like chewing the bag string of the pudding for proof. We must return the investment at some time with interest. The mistake has often been made of sapping a property into earnings to its very last minute, pocketing the earnings in dividends or extra dividends, to the point where the property reaches a condition where necessary extensive replacements or repairs must be made to maintain the proper continuity of service and provide for proper increase. What is the result? The present owners back gracefully out of the ring, taking their hats with them, leaving the ring for some one else to climb into at an apparently depreciated price, where 150 or 200 per cent has been recovered in a very reasonable space of time before that. The new purchaser takes the property, assuming practically all of the outstanding obligations which would amount ordinarily, say, to 100 per cent of the original property or more. He plasters another 100 per cent on top of that and comes back and asks for an earning capacity of 200 per cent and proceeds to carry out the same methods, backs out gracefully when he gets all he can get out of it, and the third party steps into into the ring, and does it over again. Those conditions have all in the past been practiced. There are lots, perhaps, that have not gone through that course. But public opinion has gotten to the point where that is the regular procedure of all public utilities. It is not the fact. There is at all times the man behind the gun, the engineer or operator, who has to stand there and deliver the goods. He gets up against it severely by having to deliver from the same original stuff, the same contribution of nature, an amount to supply an income on two to three hundred per cent of value where he was doing or could do splendidly on 100 or 150 per cent. A man might buy a piece of real estate and sit down and pay nothing other than his taxes. A neighbor buys a piece and puts on a large fine building. The other piece would increase in value by it. A public utility cannot do that. A man is entitled to the result of his efforts. There is a certain amount of stock issued. At the time it is issued it is worth nothing. After a period of 10 years, by steady, consistent application of effort, that stock is brought to an earning capacity without injury to the public whatever. Is there any reason why the party owning the stock should not take an income from it, any more than the party who sat down on a piece of real estate and got his advantage in the value of his real estate from the efforts and energy of the party who put the improvements on the neighboring property? We are not thieves. But we have a difficult game to engage in. We got up into a difficult situation in the case that I referred to a while ago where

a would-be expert professional witness was on the stand. He was paid $50 a day for his expert testimony. I want this to go into the record of this association because I want the association to know that the only foundation the expert witness had as a basis for his temerity in testifying in the fixing of the rate on some innocent individual's property, was the fact that he claimed to have built the original plant in a small town in a city of California. As a matter of fact we absolutely proved by the testimony that Mr. L. P. Lowe was the man who designed the plant and his brother put the plant in operation. We also brought the secretary of the company on the stand and he testified that this would-be engineer had never turned so much as a scratch of the pen for the company. Those are the conditions that have to be guarded against. It is a very easy thing for one who has facility with his tongue to get on the stand and make testimony. It is difficult to get on the stand and prove his testimony an absolute falsehood. It is easy to tell a lie, but it is hard to prove that the man is a liar. I want to warn you gentlemen against it. There are other conditions which we have to face on the Pacific Coast, especially in view of the present legislative condition, and, furthermore, where the small towns with rapid growth are coming through the way they are. As soon as they have a little authority, the officers of these communities are like the Irishman who was appointed to the police force. In the morning he got his star and his uniform and immediately proceeded home. At 2 o'clock in the afternoon his wife swore out a warrant on him for assault and battery. He came up before the police magistrate who said, "Shannahan, how in the name of common sense is it that you were appointed at 10 o'clock and at 2 you are charged with assault and battery on your wife?" He says, "That is easy of explanation. My authority had to be shown somewhere." As soon as these people get the club of authority in their hands they are after you. I want to caution you from actual experience. We have got to conduct our affairs toward the public, not only in the matter of fixing our rates, but in the general conduct of our business, to that point where we can justify exactly what we do. We want to keep our properties in such shape that they are not a dilapidated, run-down, rattletrap proposition. There are lots of them on the Pacific Coast that are still in that condition. We have to realize that there is an investment to conserve and it is up to us to deliver the goods, and we should see that that investment is perfected in every reasonable possible way so as not only to preserve it in its entirety, but to be able to continuously make our return. Just exactly what the final outcome is going to be, I do not believe any of us have gray matter enough at the present time to draw a safe conclusion. We have not come to a safe conclusion on what we mean by depreciation of what reserve should be set aside per annum for replenishment. At the same time we do know this: That there is continuously a certain amount of what we are pleased to term depreciation accruing through the fact of inadequate conditions or inadequacy of plant, together with evolutionary conditions of market changes and invention. Within the last twelve years, you may say, the oil gas business has been going through an evolutionary stage. Every man was operating a plant and operating a type of his own. His apparatus may have been economical or not. And with the conditions that existed all a competitor had to do was to stake his claim and announce that he was going to do business and that was all he had to do. It is a little different now with the state railroad commission. We don't know what they will do. If they take the socialistic view and think competition is a good thing, you may get competition right straight along the line.

President Vance—After the very interesting remarks of Mr. Barrett, I am going to call on Mr. Frank Leach of Oakland.

Mr. Leach—Last year after Professor Cory's very excellent paper had been read a motion was made from the floor that the paper be furnished to all of us for our guidance in the immediate future. It seems to me that such action should be taken in regard to this paper, together with the article on depreciation which Dr. Humphreys has sent as an appendix to his paper, and I would make such a motion.

(The motion was seconded and carried.)

President Vance—Gentlemen, in closing the discussion on this paper, Professor Cory has indicated to me that he would like to say a few more words.

Prof. Cory—I have appreciated the discussion this afternoon. The difference in the methods of manufacture and distribution of gas on the Pacific Coast as you men know it and as Mr. Jones has indicated, and the methods of manufacture and distribution in the East and on the Continent should be taken into consideration in the discussion of the matter of overloading of gas manufacturing plants and the distributing systems connected therewith.

On the Pacific Coast in many cities such as Los Angeles the amount af gas sold has increased from 100 to 200 per cent within a five-year period from a single gas manufacturing plant. In such cases construction and operation are continuously going on at the same time, and it is not a question of what is the ultimate capacity of one gas generating set, but the ability to keep up with the increase in the amount of gas demanded by the community, and the increase has been so great in a short period of time that we have by force of necessity found new maximum ratings for our oil gas generating sets.

I value most highly the discussion by Mr. Barrett of the financial problems confronting the public utility corporations. Unless I am much mistaken, the matter of rates is not of as much importance today to the public utilities on the Pacific Coast as the inability of such public utilities to obtain the money to enlarge their plants and extend their systems to keep up with the growth of the community which they serve. I quite agree with Mr. Barrett also that the average of a given set of conditions can by no means be used as a guide to lead us in prophesying for the future. If averages are to be depended upon for instance it would not be as hot in San Jose today, because the maximum temperature today, unless I am much mistaken, is about twice the mean annual temperature claimed for San Jose by its Chamber of Commerce.

STANDARD OF QUALITY AND PRESSURE OF OIL GAS.

BY H. PAPST.

(Pacific Coast conditions are considered, but the author deals with fundamentals. Proper standards of quality and pressure are essential that the best service be secured. Consideration of maximum by-product should influence quality and would result in greater value of the gas to the consumer and to the company. Legislation based on exact knowledge rather than precedent is urged in this connection. The paper was read at the Pacific Coast Gas Association convention, 1913.—The Editor.)

With the advent of public service commissions the question of establishing proper standards of quality and pressure has received an impetus, due to the fact that rates are inseparably connected with standards of quality. All such considerations ultimately resolve themselves into conserving for the benefit of the public the natural resources of the country and extracting from them the greatest value in the most efficient manner. This view has been adopted by commissions, and being well established, may be used as a basis upon which to elaborate.

It is obvious that one standard, equitable for all sections of the country, is out of the question, since each community is differently situated as to the kind and quality of raw materials available. For this reason, the most suitable raw material, treated in the most efficient manner, from a conservation standpoint, will indicate the proper quality of supply in each locality.

Based upon the above premises, this paper will treat of Pacific Coast conditions, with special reference to oil gas.

Without going too much into the history of oil gas manufacture, which has been ably set forth in earlier meetings of this association, it still becomes necessary to consider the surviving methods of production, as exemplified in a few of our large cities.

The early history of oil gas manufacture has its seat in Southern California, co-incident with the development of the oil fields. The prevailing practice is to distribute a medium grade gas of slightly above 600 B.t.u., with the production of moderate quantities of lampblack and rather large quantities of pitch and tar. To Southern California belongs the distinction of first working up the lampblack into commercial fuel, representing a by-product of such value as to seriously influence the determination of quality.

In the northern part of the State of California the practice differs by the production of a richer oil gas and the admixture of the same with blue water gas made from the briquetted by-product, lampblack, giving a final product stated to be of 650 B.t.u.

Oil gas manufacture in the Northwest has been somewhat similar to the Southern California practice, except that the production in these plants is along the lines of large yields of gas and lampblack, with a minimum production of pitch and tar.

A comparison of these divers methods, along such radically different lines, shows the necessity for a thorough investigation to determine which best represents efficiency in production and conservation of natural resources.

It is evident that the final value to the consumer from a gallon of oil must be the deciding feature, which should be expressed in some definite standard, and I believe that at the present time the consensus of opinion is that such a standard should be expressed in terms of heating value only.

Standard of Quality.

The commercial efficiency of the manufactured product seems to be dominated entirely by the question of by-products. In the manufacture of oil gas the briquetted carbon has proved to be the most wonderful of all solid fuels—a worthy companion of gas in its purity and efficiency. The profits to be derived from the sale of this commodity enormously increases the field of operations of a gas company, attracting new consumers without losing the old ones. It has practically met a long felt want, namely, wholesale heating, for the day is not yet present when gas can compete with other fuels for this purpose. By keeping out the coal man we can keep in the gas meter.

A feature in this connection is the reduction in overhead expense by increasing the volume of business transacted. The more one considers, the more fallacious appears the utilization of salable by-products for the production of gas, when the latter can be produced by the purchase of additional raw materials, without the loss of any profit from residuals. The writer of this paper wishes to go strongly on record as favoring the production of as much lampblack as possible, even at the expense of the gas yield, with the complete elimination of tar and pitch.

It would seem that the greatest economy in operation is reached with the cessation of the production of tar and pitch, at a point ranging between 535 and 550 B.t.u. The consequent reduction in holder costs, due to the additional briquet sales, enables the selling price of gas to be correspondingly reduced, thus working a direct benefit to the consumer. It is obvious in this connection that one opens up, also, new fields for the use of gas along industrial lines, which must result in a further increase in volume.

Besides the increase in volume and the reduction in selling price, we place in the hands of our solicitors a formidable weapon against a straight crude oil heating system, principally on the score of safety and simplicity.

The development of the gas business along the lines of these ideas has hitherto been handicapped by legislation, but a definite stand by the Pacific Coast gas fraternity should be productive of results with the commissions or local authorities.

The distribution of gas, from the standpoint of quality, is all in favor of a gas containing no hydrocarbons in vaporous form; in other words, a gas in which all the vapors have been converted into either lampblack or gas. It is obvious that a low grade gas will not suffer in transmission by high pressure (and high pressure distribution is much practiced on this coast), and it has been likewise found that the problem of pipe jointing, as met with in rubber Dresser gaskets, has been much simplified by the elimination of the hydro-carbon condensate. On the other hand, the gas meters, which are, after all, the index of our earnings, have been found to attain an extraordinary degree of accuracy, extending over a much longer period when the diaphragms are no longer subject to the dissolving effect of liquid hydro-carbons. On account of the lower specific gravity of the gas, there also results an in-

creased efficiency in transmission and distribution by the greater capacity of the system, with a corresponding reduction in the investment charges.

Having discussed efficiency from the standpoint of production and distribution, it now becomes incumbent to consider the same from the standpoint of utilization. The requirements of the consumer must be examined, in order to ascertain if his needs can be adequately served by the quality found to be the most efficient from the production and distribution standpoint. Modern investigation, represented by the experiments of Dr. Bunte and others, shows that the efficiency of combustion has but little relation to the calorific value, but that the various uses of gas are far more dependent upon other factors, such as flame temperature, flame volume, and the specific heat of the nitrogen and other products of combustion, as will be further dealt with under the requirements for pressure standards.

On the other hand, gases of high calorific value, meaning high percentage of hydro-carbons, are difficult to burn completely, and this imperfect combustion tends to the production of odors, and in some instances to the production of dangerous carbon monoxide, likewise to the blackening of ceilings and fixtures, which is detrimental to general cleanliness, the strongest asset of gas for fuel.

The writer's personal experience in Portland, where candle powers from 15 to 19 have been distributed at various periods in connection with the reduction of sulphur compounds, previous to the introduction of the reheating process, has fully demonstrated that the public greatly preferred gas of a lower quality, from a convenience standpoint, as shown by the large number of complaints resulting in connection with high candle power, and the cessation of the same with the re-establishment of a lower standard.

The considerations presented above in connection with the proper standards of quality might seem to be dictated by the personal experience of the writer. It is therefore pertinent to mention briefly what seems to be the trend in the East and abroad. The recent investigations by the committee on calorimetry of the public service commission and gas corporations in the second public service district of the State of New York have shown a radical change of ideas in favor of a lower standard from those previously accepted for many years, with strong leanings to still further reductions eventually. Quoting from this report, page 12, article 34, "It is difficult, indeed, in view of the uncertainty as to just how fast certain changes in the conditions governing gas manufacture and distribution will take place and as to what the final situation will be, to determine the proper value at which to set the standard. It has been shown that some time in the future the standard may have to be 525 heat units, or lower."

The standards abroad have crystallized even more definitely in favor of a very low standard. In 1906 the calorific value of 500 net B.t.u. gas was adopted for Tottenham, in England, while previously illuminating value of the London Company were in force equivalent to calorific value fully as low. On the continent, Paris and Rheims have adopted a value of 528 net B.t.u., and Milan, Italy, 573 B.t.u. In Germany, during 1909, it was concluded that there should be a calorific test and that the same should be set at 543 gross B. t. u. It should be noted in this connection that it is customary on the continent to correct the gas volume to 32 F., instead of 60, which means that the standard is comparatively 5 per cent lower than these figures; e.g., 543 gross would become 516 gross. In South America, Colombo has had a heating standard of 400 B.t.u. for the last five years and in Buenos Ayres it is required that the net B.t.u. shall not be less than 539.

From the above it will be seen that nothing radically new has been advocated by the writer in connection with the standard of quality. The recommendations are made solely on an efficiency basis and from the standpoint of the economical development of the industry.

Entirely too much legislation has been enacted solely on the strength of precedent; indeed, the gas industry has been too much hampered by its traditions. Is it not time to cut loose from meaningless standards, allowing the industry to expand along logical lines of development, represented by lower prices, and, since most companies are all organization and no output, by increased volume and larger net earnings?

Standard for Pressure.

Before entering into the question of proper standards for pressure, it is pertinent to inquire what function is fulfilled by the pressure requirements in the distribution of gas. These may be divided into, first, the requirements for the transmission of the gas through the mains, and second, the needs of the consumers' appliances. When gas is transmitted by what is commonly known as high pressure, the distribution problem does not enter, while the distribution of gas by low pressure, as measured in inches of water, bears a fixed relation to the area of the territory to be covered and the capacity of the system of mains with respect to the volume to be furnished.

It is at once evident that we are confronted again with the requirements of the locality. Considering that most of the localities have been established for many years and that the distribution systems have grown up with the community, conditions may readily prevent a realization of the ideal system from a theoretical standpoint. The public service commission may, however, and should, insist on such expenditures as are possible and advisable to correct any glaring defects. Assuming that this has been done, it is obvious that the initial pressure to be carried must be such as to give service to the most remote consumer. A differential pressure is commonly assumed of one-half inch per mile of main, and this would seem to be a fair allowance to supply the neecssary volume. This amount, should, therefore, be added to the necessary pressure required by the consumer.

One must also consider the fluctuations of pressures, which are the principal cause of complaints by the consumer. It is apparent that with the higher initial pressure the percentage of fluctuation will be less at the outskirts of the system and regulation correspondingly easier. To illustrate: If the extreme points of the system are three miles from the nearest holder, it will mean a variation of pressure of at least 1½ in. at the initial point, so that if the maximum

allowable pressure were three inches, the suburbs would have only 1½ in., or a variation of 50 per cent. But if the maximum pressure allowed were eight inches, with the same loss in transmission, it could be arranged so that there would be no variation in the suburbs, while the variation at the initial point would not exceed 20 per cent.

In addition to the foregoing, there remains the question of altitude—a factor beyond the control of the utility. An allowance for the same has always been considered in previous regulations by the commission.

Pressure requirements have always been somewhat dependent upon the specific gravity of the gas, which, again, depends upon the quality of the gas manufactured. It follows, therefore, that to provide the same results, the street pressure must be varied inversely as the specific gravity.

Now, considering pressure from the standpoint of utilization, it is at once seen that the proper pressure is dependent upon the quality of the gas, that is to say, insofar as quality influences the specific gravity. Inasmuch as nearly all appliances burning gas use a syphon effect for mixing the gas with proper portions of atmospheric air, and since the amount of air entrained into the mixture is proportional to the mass of the gas, and since the mass is proportional to the specific gravity, it follows again that with different specific gravities, to produce the same result will require a different street pressure.

It has been found that a very much greater efficiency in the utilization of gas may be brought about by approaching as nearly as possible to the theoretical limit of primary air admitted for complete combustion. Inasmuch as the limiting feature in air mixers is the propagation backward of the explosion wave, which must be overcome by the velocity through the mixer of the air and gas, it is essential that the pressure furnished must be ample to insure this result. It follows, likewise, that the higher the pressure available, the nearer the mixture may be brought to the theoretical limit, which means, in turn, greater efficiency in utilization.

These facts have been very strikingly illustrated by the increased efficiency of incandescent lighting by means of the higher pressures, such as, for instance, the wonderful street lighting systems now developed in European cities. The same applies likewise in a lesser degree to ordinary incandescent lighting by low pressure. To illustrate these remarks I had our laboratory make some experiments, which show how remarkably the consumer benefits by increased pressures.

Increased Efficiency of Incandescent Burners With Increasing Gas Pressure for the Same Consumption of Gas

Test made with an upright Welsbach mantle.
Gas Rate 3.2 cu. ft. per hour.

Pressure in.	Candle Power.	Candles per cu. ft.
3	39.1	12.2
4	41.9	13.1
5	44.7	14.0
6	47.5	14.8
7	50.3	15.6

As a corrollary, the lighting capacity of the various units is much increased, enabling competition with electric units to be more easily met by the standard burners. To illustrate: A 4-burner gas arc can be replaced advantageously by a 3-burner arc, providing the street pressure is available to operate the same at high efficiency. It follows, also, that the danger from flashbacks in the mixer is much reduced when the higher pressures are available.

The consumer benefits, in addition, by a saving in time, effected by the increased rate of combustion, which incidentally reduces the radiation losses.

The requirements of the industrial appliances, without going into detail, necessitate, in the same manner the greatest available pressure at the nozzle. In many cases a lack of the same makes it necessary to install booster, or air blowers, at an additional expense.

From the above it would appear fallacious and to the direct detriment of the consumer to require an upper limit on the pressures carried in the distribution system. No gas company will increase the pressure in its mains beyond a point of economical demand, influenced by a fear of leakage, although it does not appear in any sense that the higher pressures are anything but a blessing to the consumer.

Summary.

With regard to the standards to be adopted on the Pacific Coast for oil gas, and with due regard to the development of our business, these should be based upon the most efficient methods of production with respect to the conservation of our natural resources, and it appears, furthermore, that oil gas conditions would require the production and distribution of a gas of lower calorific values than those at present prevailing, especially in the California cities, and that the same is in accord with the trend of gas practice in the Eastern states and abroad. Conditions for pressure would require that no upper limit be placed for efficient utilization of our product.

Conclusion.

Inasmuch as no standards have as yet been established for oil gas on the Pacific Coast, it behooves us in this convention assembled, representing all sections of the Pacific Coast, to determine in advance of any decision the proper standard which we should urge upon the commissions, lest ill advised legislation, which is always difficult of repeal, should retard our further progress.

While the writer's ideas are set forth, he hopes that a full and free discussion will result, leaving it to the appointment of a committee to give the matter a full and thorough investigation.

Canada's waterpower is estimated at 16,600,000 h.p., of which only about 1,016,000 h. p. has been developed.

The manufacture of ice calls for a consumption of 46.89 kw.-hr. per ton according to data compiled from three large plants.

Electricity in Rural Districts, a report made by the commercial section of the National Electric Light Association to the Chicago convention last June, contains much valuable data on power required, costs, etc., of farm machinery.

WRINKLES.[1]

BY H. W. BURKHART.

1. **Appliance Stand.**—(Fig. 1) This consists of a very simple, cheap and durable stand for mounting appliances in the display room and also serves as a truck to easily move appliances around. It can be adjusted to meet all conditions. The stand consists of maple disks, 4 in. in diameter by 2 in. thick; counter sunk 3 in. x ⅜ in. At right angles to these disks holes are bored one inch deep. Into these holes ordinary black pipe

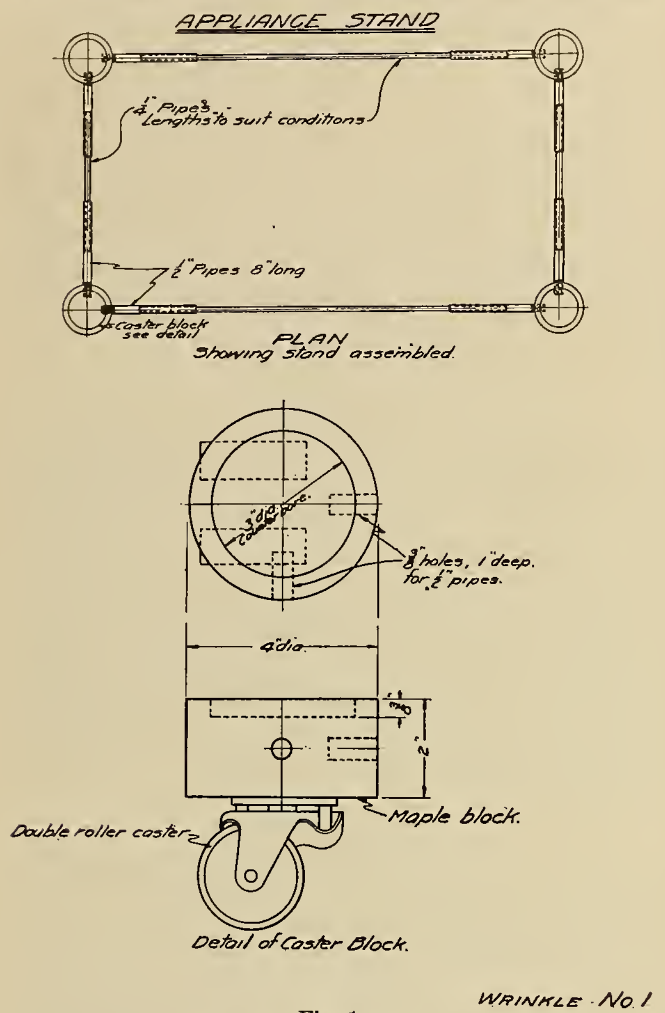


Fig. 1.

is inserted and the whole assembled as in sketch. On the bottom side of the disks double roller casters are mounted.

Frank Wilson.

2. **Measuring Tank for Oiling Gas Meters.**—(Fig. 2) This consists of a tank made of No. 20 gauge galvanized iron, 18 in. high and 9 in. dia. Inserted in one side is a gauge glass made of heavy plate glass 10 in. x 2 in. This is set in a frame with a scale marked on one side for measuring the amount of oil to be used for each meter. The divisions in the scale are 7/16 in. apart, which equals one pint of oil. The tank is to be filled with oil to the top of the glass, which would be about 3 gallons. The remainder of the tank is for air pressure which is supplied by an ordinary automobile air pump through an ordinary air hose such as is used in a garage or bicycle shop. On top of the tank is a 5 light meter screw taken from the side pipes of a meter with a tubing cock screwed in for attaching the air hose. At the bottom of the tank there is a ¼ in. lever cock with a short piece of air hose attached. The end of the hose has a piece of copper tubing about 3 in. long; the end of this copper tubing is inserted in the holes punched on either side of the side pipes on the outer side of the meter. By turning on the lever cock the required amount of oil can be forced in the meter without any waste whatever.

By the use of this device a 5 Light Meter can be oiled in about 25 seconds, where by pouring the oil in it takes over a minute. We find this device to be one of the most economical and essential things used in the meter shop. However, if we were to make another we would use a regular water gauge glass in place of the plate glass.

W. H. Partridge.

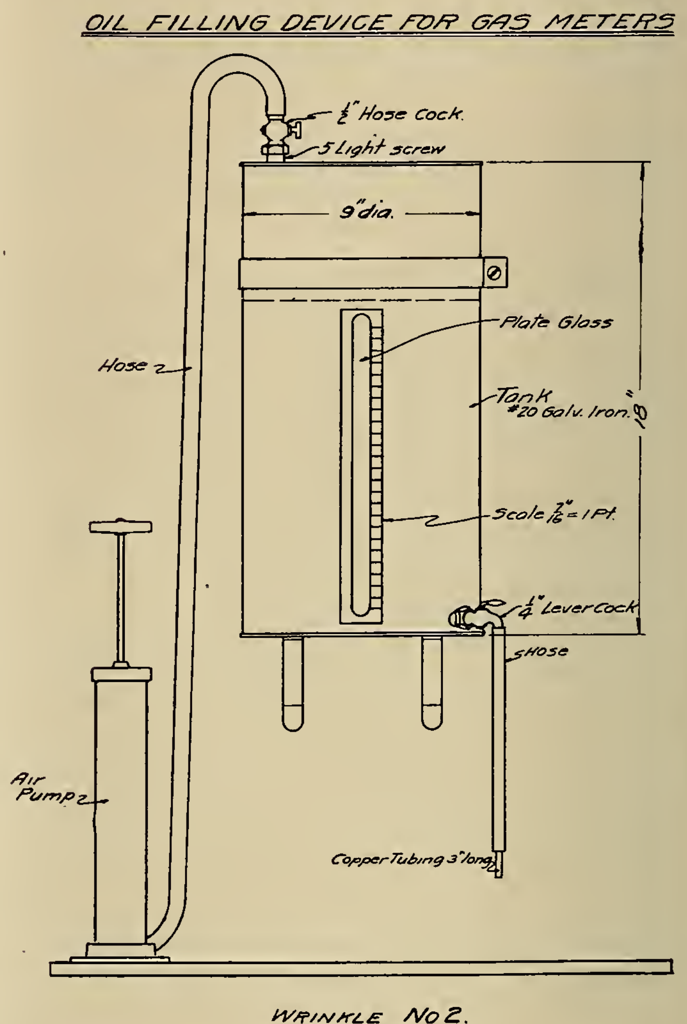


Fig. 2.

3. **Superheated Steam for Oil Gas Generators.**—In most oil gas plants, steam is used for injecting oil into the gas generator, the amount of steam depending upon the amount of oil being used. It was thought that if this steam could be superheated, without additional cost, a saving would be made. To this end a coil of pipe was arranged inside the gas off-take pipe, or generator stand-pipe, as close to the generator as possible. After passing steam through this coil we were enabled to get a 50 degree superheat from the heat of the generated gas passing through stand-pipe on its way to wash-box.

The result was a material saving in fuel oil used for heating.

J. F. Creighton.

4. **"Benso" or Distillate, Obtained From High Pressure Gas Mains for Use in Auto Trucks.**—In the drippage, from our high pressure mains, we obtain an oil which, when distilled, is used for fuel in our auto trucks. The still used for distillation is made from a 24-in. tee around which is built a furnace. It has a capacity of 200 gallons per day, and 4c per gallon would easily cover the cost of operation. The fuel used for this still is muck from the wash-boxes of our oil gas generators.

[1]These wrinkles, contributed by members, were submitted by Mr. Burkhart at the twenty-first annual convention of the Pacific Coast Gas Association, 1913.

The product, after distillation, is termed "Benso," and has a gravity of 45 degrees Be' and a flashing point at room temperature. We are using this "Benso" very successfully in our automobile trucks by the use of a gravity raising device, before the carburetter, which is obtained from automobile supply dealers.

J. F. Creighton.

5. **Hot Air as Conveyor for Fuel Oil Under Furnaces Where Steam Is Not Made.**—The excessive expense of the use of compressed air, at atmospheric temperature, for injecting oil for fuel purposes is well known. It was thought possible to obviate this by heating the air after compression. This was done by setting a coil, (approximately 100 ft.) of one in. pipe, cut in six ft. lengths, in part of furnace that would keep temperature of air at approximately 450 degrees, Fahrenheit.

The results obtained were very gratifying.

J. F. Creighton.

6. **Collapsable Leak Tube.**—(Fig. 3) We have several inspectors whose duty it is to follow up reports of leaks in streets, who have been carrying short lengths of half-inch pipe to insert into the sewer inlets, manholes, openings in streets, etc., for the purpose of locating leaks. The pipe was rather cumbersome, therefore we use the collapsable tube which folds up and is easily carried in the pocket, being a very compact and handy instrument for the work.

D. E. Keppelmann.

7. **Testing Cap on High Pressure Work.**—(Fig 4) For testing high pressure mains it has been necessary to use the great-

TESTING CAP

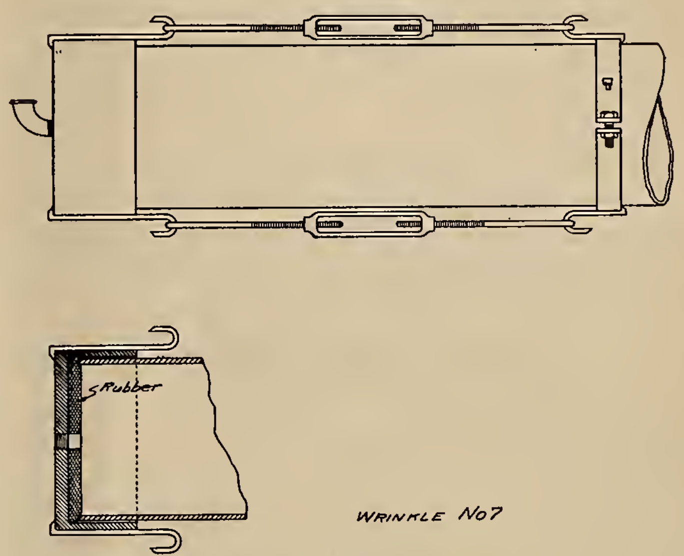


Fig. 4.

COLLAPSIBLE LEAK TUBE

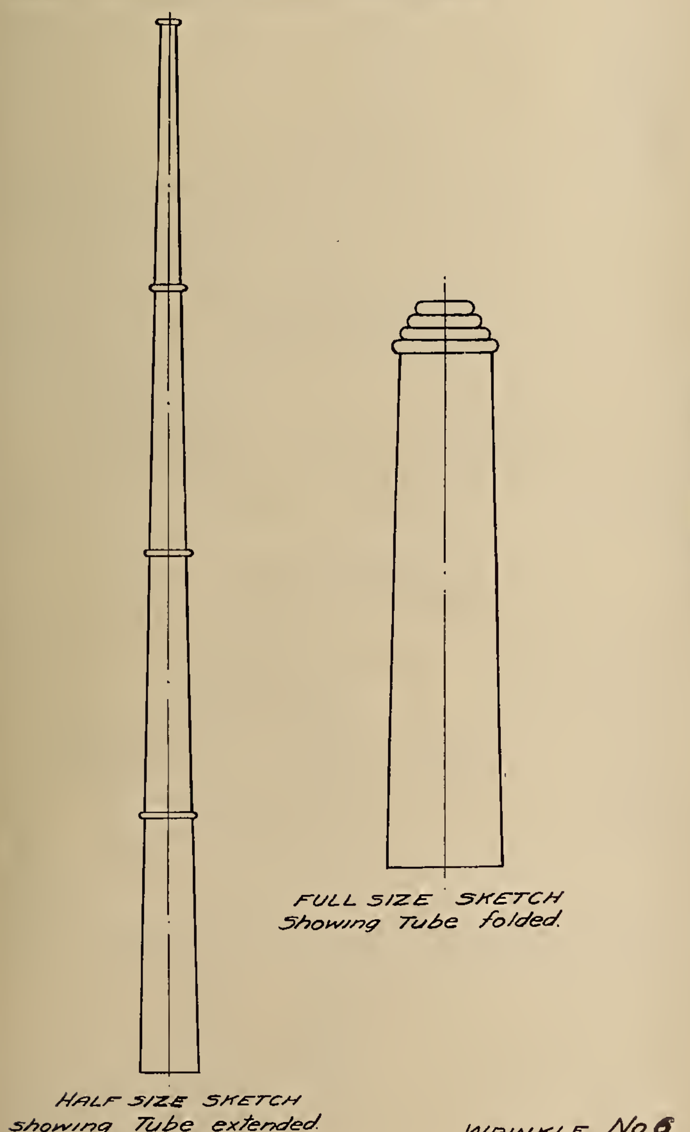


Fig. 3.

COLLAPSIBLE PIT FORM

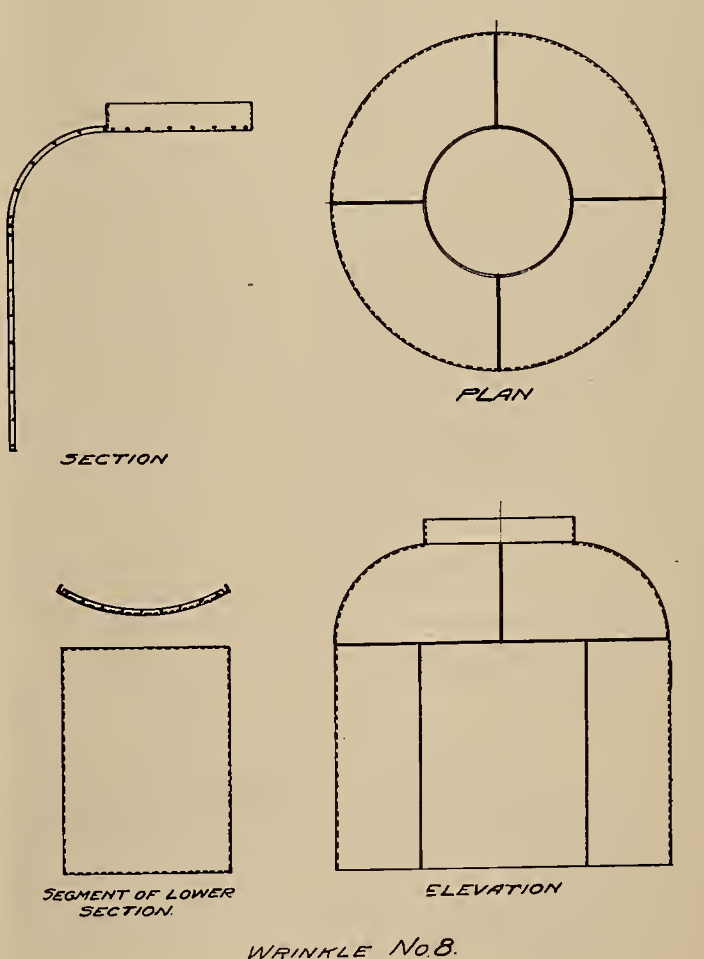


Fig. 5.

est care in bolting on a blank flange or head together with the necessary barricading which was a long and tedious job and not always certain as to its absolute security. Instead, a testing cap is placed over the end of the main and bolted to a lag screw to the main being tested. It is always ready, easily adjusted and is absolutely secure.

D. E. Keppelmann.

8. **Concrete Pit Form.**—(Fig. 5) With the installation of concrete pits for housing district governors, it was necessary in each installation to build a form with wood at considerable cost for labor and material. After the completion of the pit the wood invariably had to be thrown away, or at least could not be used again for the same purpose. The accompanying line drawing (Fig. 5) shows a collapsible pit form made of corrugated iron in six different sections. After the hole is dug in the street the form is bolted together in a few minutes, set into position and after the concrete is set each section quickly unbolted and removed, and is again ready for the next operation. This is a great labor and material saver.

D. E. Keppelmann.

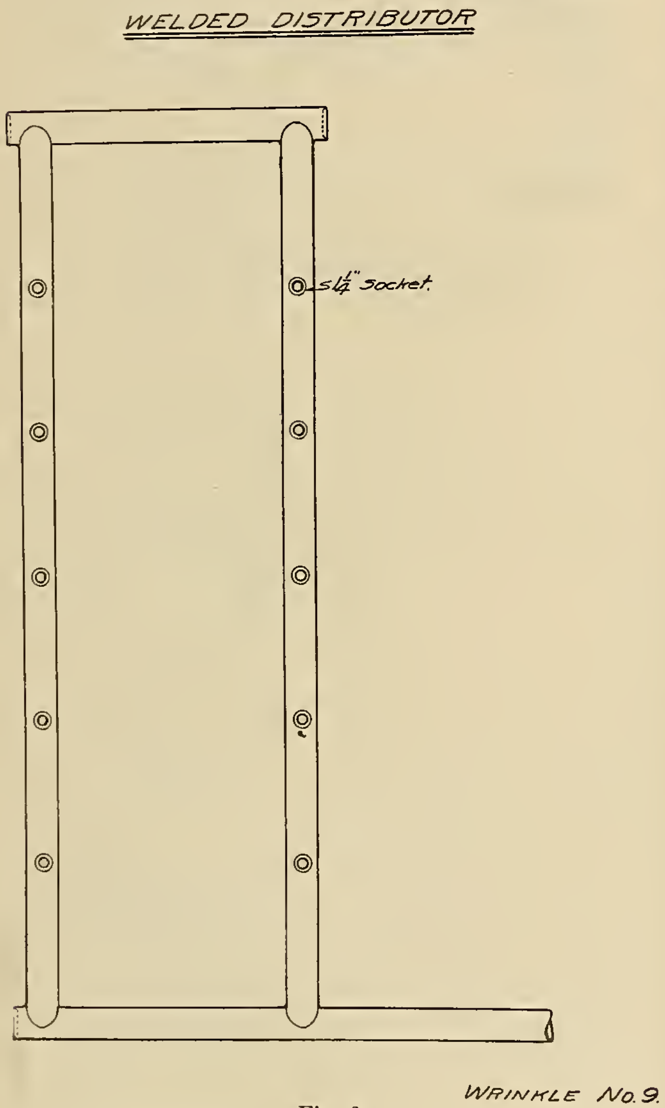
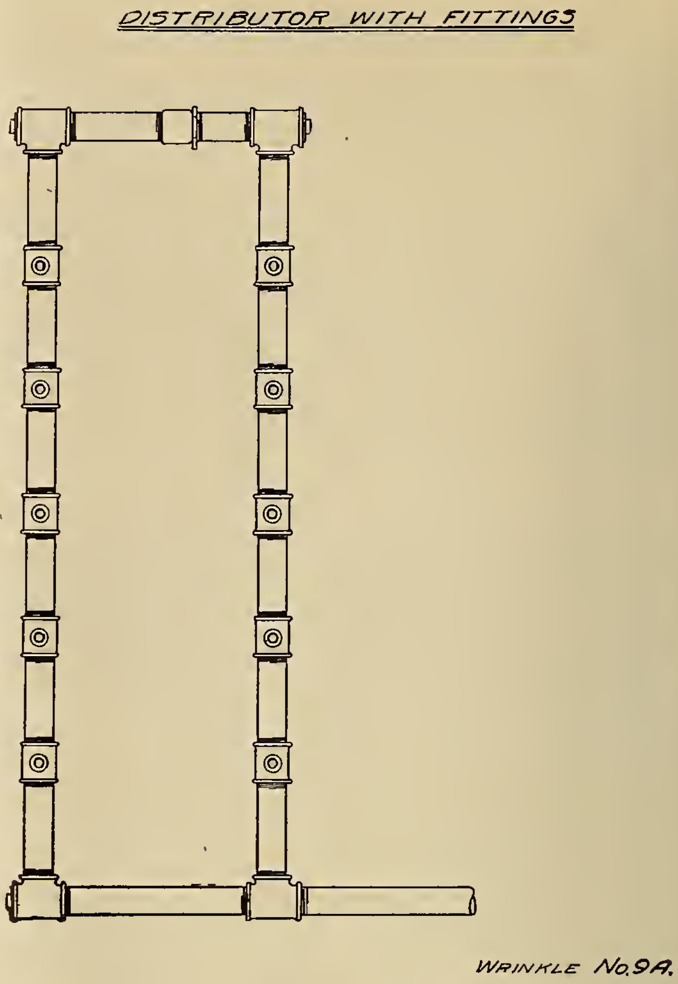


Fig. 6.

9. 9a. **Welded Distributors.**—(Fig 6) The distributor is shown with outlets to meters. On large services, 3 in. and 4 in., these fittings are very expensive and the labor required to cut the necessary nipples and fit these together makes a distributor an exceedingly expensive installation. (Fig. 7) shows the same distributor, the pipes being welded together and holes burnt into the pipe and socket inserted and welded for outlets to meters. The saving on fittings and labor is 50 per



cent and makes an absolutely permanent installation. The welding is done by the Oxy-Acetylene Process.

D. E. Keppelmann.

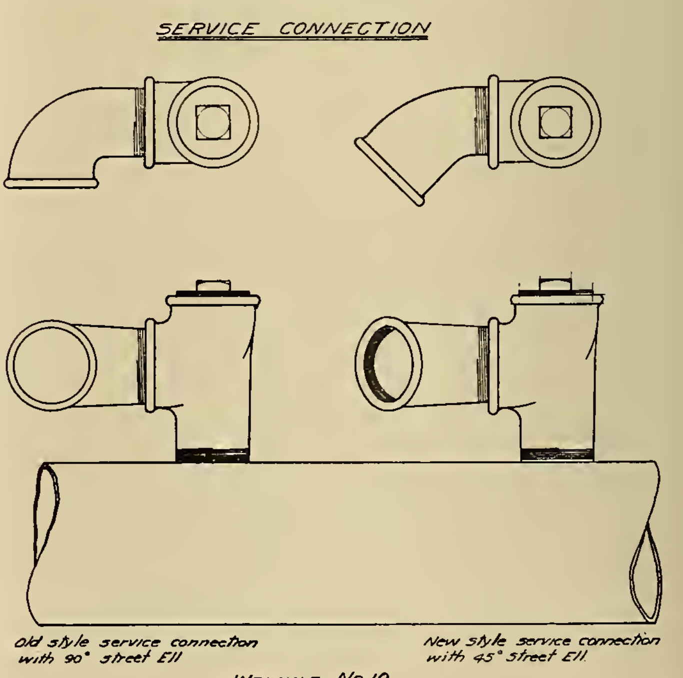


Fig. 8.

10. **Service Connection.**—(Fig 8) The old style service connection consists of a street tee inserted into the main with a 90° street ell. This brought the flow of the gas at right angles, causing some stoppages at times. The 90° street ell

has been eliminated and in its stead we now use a 45° ell, making the flow more direct.

D. E. Keppelmann.

11. **Emergency Gas Stopper for Mains.**—(Fig. 9) Sometimes it becomes necessary to replace a 3 in. or 4 in. main with a larger size. A hat flange is found providing outlet only for the smaller size main, necessitating the replacing by a larger hat flange providing outlet for the larger main. In order to prevent the flow of gas without necessitating bagging off the main, a piece of heavy rubber of sufficient size to cover the opening is rolled and inserted through the opening with a string attached. The pressure of gas unfolds the roll of rubber and blowing it against the opening in the inside and is

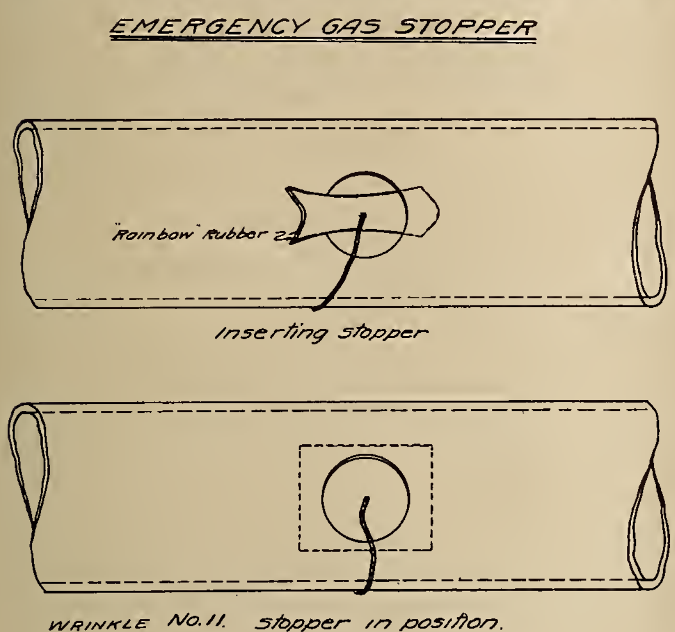


Fig. 9.

held there until the larger opening is made and the new hat flange bolted on. This has been used very successfully, has eliminated a great many difficulties which occur in an operation of this kind.

D. E. Keppelmann.

12. **Rubber Stopper for Service Connections.**—(Fig. 10) Frequently we receive an order for the installation o. a service on existing 2 in. mains, this necessitating cutting the main and inserting a tee in the line. To prevent the loss of gas and annoyance to customers, as well as to overcome any possible damage to the fitter, the cut in the main is made and a 2 in. rubber stopper with a string attached placed in each end of the cut main, stopping the flow of gas. The main is threaded, tee inserted and the stopper withdrawn by pulling the strings through the outlet of the tee.

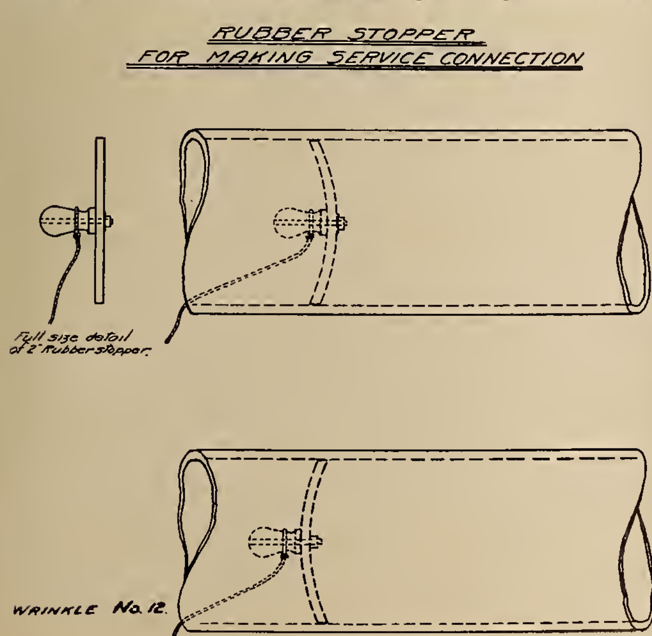


Fig. 10.

D. E. Keppelmann.

13. **Shutting a Valve Under Hot Water.**—In order to put a foot valve on the suction of our circulating water pump it was necessary to shut off the water from the settling pits to the well. The valve used for this is a common irrigating

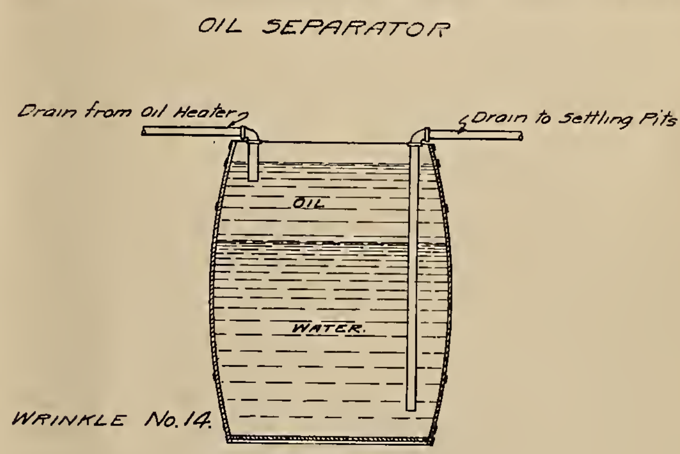


Fig. 11.

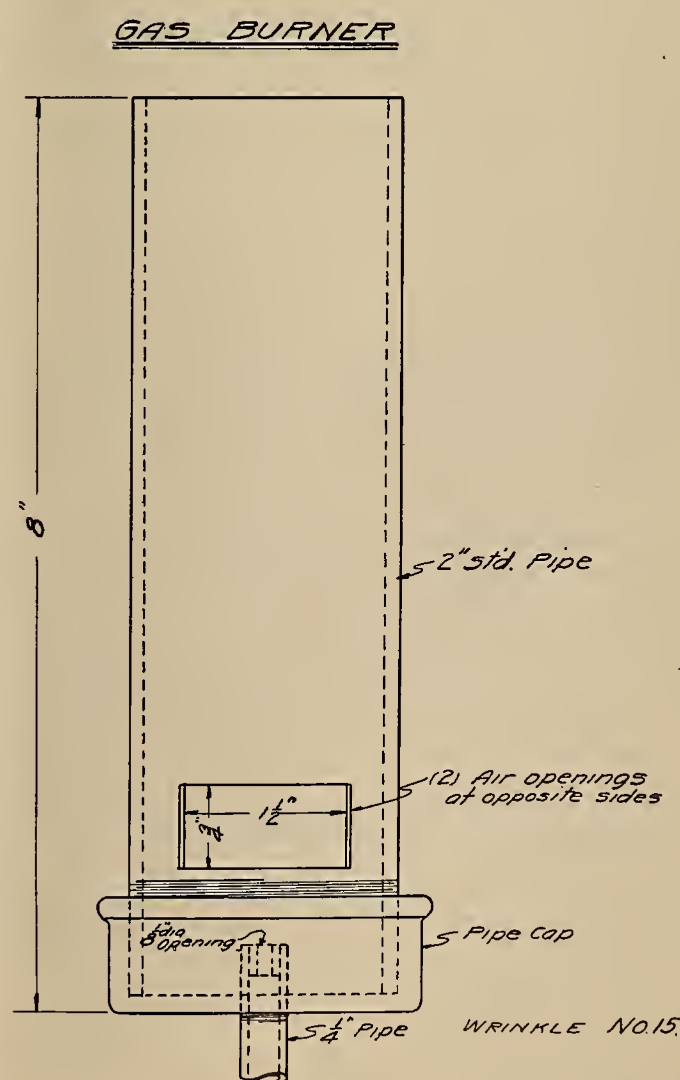


Fig. 12.

gate, the top of which is about twenty inches under water in the last pit. In some way the gate had been pulled out of the guide slots and we could not get it back in place without using our hands to guide it. As the water was too hot to work in we were up against it until the thought occurred that if we put a piece of pipe down in the water directly over the valve and turn cold water down it a man's arm could be inserted through this pipe. The force of cold water running down the pipe kept the hot water away from the man's hand which was below the pipe. We used a piece of 6 in. stove pipe and a ¾ in. hose.

D. W. Connell.

14. **Oil Separator.**—(Fig. 11) Our oil heater began to leak and enough oil ran through the drain, which runs to the settling pits, to make a mess on the water. To avoid this we put a barrel on the ground as per sketch and by dipping the oil out of the barrel about once a week we had no more trouble.

D. W. Connell.

15. **High Pressure Gas Burner.**—(Fig. 12) While running a 7 in. suction line from the circulating water pump and after having two pieces screwed up we found it would be necessary to bend the pipe. We therefore constructed the burner as per sketch. The bend was made directly over a 10 in. gas pipe. We raised the 7 in. pipe a few inches and covered the gas pipe with dirt, placing a brick on top of the dirt and a piece of iron on the brick to keep from crushing it. We then laid some old fire brick around the 7 in. pipe, about 12 in. apart, to form a sort of furnace to hold the heat. Five minutes after the gas was lighted we had the pipe bent.

D. W. Connell.

EXPERIENCES.[1]

BY JOHN CLEMENTS.

At that delightful, ever to be remembered, twentieth session held in the city of San Diego, the President honored me with the appointment of editor of the Experience Department.

The duties imposed by this appointment seem to me to have grown more and more important, as the present twenty-first session draws near. I fear, however, that its importance is not shared by many of my fellow members, or it may be that they do not fully understand what is meant by the term "Experience." I have asked myself this question several times in the past few months. The term or word "Experience" is defined by the authorities, as that which has been learned, suffered or done considered as productive of practical judgment and skill; the sum of practical wisdom taught by all the events, vicissitudes and observations of one's life, or by any particular class or division of them.

To quote from Emerson: "In a world so charged and sparkling with power, a man does not live long and actively without costly additions of experience, which though not spoken are recorded in his mind."

On June 9th of this year, our secretary sent out my appeal to you for help, asking you to send me in some of your personal experiences, along the lines in which we are mutually engaged. In the appeal, I enumerated the various lines as follows: Manufacture and Distribution; Gas Lighting; Gas Heating; Gas Cooking; Sale of Gas Appliances; Rentals; Collections; Your Experience With Gas Versus Electricity; Consumers' Complaints; Personal Experiences With Individual Consumers, etc., etc.

The past year has indeed been an eventful one, full of experiences for many if not all of us. Many of them would have been good reading for this paper but owing to the proverbial modesty of the gas man, they have not been considered of sufficient importance. So on these grounds, I excuse you this time, but insist that you do better for my successor.

Gas Lighting.—Under this head, we find that gas lighting is still advancing, the gas arc holding first place where a great and concentrated amount of light is required, for large stores, factories, and outside illumination where volume of light and economy are considered.

It is not the purpose of the editor to point out any special type of arc lamp or of any special make of gas appliance, but here is a very good story that comes awfully near doing it. This story was given out by the Gas Arc Department of one of the large cities and has been published in a special magazine, but as the circumstances connected therewith has to do with one of the members of this association, I have deemed it worthy of repetition: An old colored man called at the gas appliance store in ———————, Cal., to place an order for one or two gas arcs. This man, like many others, did not know the type of lamp he wanted, but remarked that he had heard of the Welsbach and the Humpback, and asked our fellow member which one he would recommend.

Gas Heating.—Gas heating is becoming more popular every day, thus increasing the make and output in all the plants on the Pacific Coast.

The various types of automatic water heaters are growing in favor—the fact that hot water can be had at the faucet as readily as the cold water, induces people in modern houses to install and use such appliances. In the more humble homes of working men, we find the circulating boiler heater. These are convenient and economical; are easily and inexpensively installed. Most any handy man can connect them up and get results.

One of our members reports a case where a handy man made such connection and got results. It happened in this wise: This handy man purchased a water heater and thinking he would save a little money, he told the man at the appliance store that he wanted the lowest possible price on the heater; that he intended to do the plumbing work himself. The result of this was, that this man connected the fuel run to the water connection and the further result was that something more than ordinary condensation got into the fuel run, the meter, and in the main outside, with the further result that he not only put his own appliances out of commission but that a great many others were without gas and the company received a great many complaints at the same time, with a big job on their hands to find a low place in the mains and let out the water. Besides all this, many persons not knowing the real cause, complained of rotten service.

Gas Cooking.—In gas cooking a member sent in an experience: We sold a lady a first class range. After we had installed the range, the lady complained of too great heat in the oven, causing cakes, bread and pies to burn on the bottom. Over the phone, we suggested to this lady that she cut down the flow of gas to oven burners. We did not hear anything more from this lady for some time and supposed everything was all right. Finally we heard from her again. This time, however, the complaint was the reverse. Her complaint was that she could get no heat on the bottom. We then asked this lady to let us send out our lady demonstrator. She answered, "Yes, by all means, send her out." This we did and the demonstrator found two inches of sand spread all over the bottom plate of the oven, thus holding back the heat from the bottom and directing it down into the broiling oven. The demonstrator, of course, removed the sand, raised the rack, did some baking, the result being full satisfaction. Meeting the man of the house sometime afterward, we asked how his wife was getting along with the gas range. He answered, "Fine! Since your Demon-Straightener came out and removed the sand, everything is O. K."

Rentals or Sales on the Installment Plan.—From a furniture dealer, who says: "We have been quite successful in

[1]These experiences, submitted by members of the Pacific Gas Association, were presented by Mr. Clements at the San Jose convention, 1913.

the sale of gas ranges on the installment plan. We find that the gas company is not very liberal in extending credit to would-be purchasers. At least that is what the would-be purchasers tell us. We sell any of our goods on the installment plan and of course this includes gas ranges. Usually the gas range is sold along with other household goods and collections are made monthly or weekly as the purchaser arranges. We find that the average young woman wants a gas range or else she will compromise on a coal range with a gas attachment and I suppose you gas company people find that even then she is most liberal in the use of the gas attachment. Of course, if we sell her a coal range this means that the hot water for bath and other uses is heated from the coal range, but where we sell a gas range, we usually sell a circulating boiler gas heater, and that means that all fuel used in the house is gas." Asking this party if they made any special effort to sell gas ranges, they answered, "Oh, no, we show people our stove department and let them choose for themselves." You gentlemen managers of gas companies, note what the furniture dealer has said; ponder on it and govern yourselves accordingly.

Collections.—The most important feature of all business. It is one thing to make a sale or to furnish a commodity but it is quite another thing to gather in the shekels. As the sale of gas is of its very nature, a credit business, because of the fact that it cannot be bought, sold or delivered in the lump sum, the question of collection is all the more important. The consumer has completely used up, destroyed, our product several days, weeks or months, before we can call on him for payment. We can not by any legal process obtain possession of the goods we have sold him, therefore, it is all important that collections be promptly made. The experience of this department and of the individual collector are too numerous to mention. The greatest tact and patience are required of those who handle this branch of our work. Many excuses and complaints are offered to the man that rings the door bell of the average consumer. Therefore, I should say that a man must at all times be self-possessed, be able to hold back the wrath that is in him, always polite, do the best he can to gather in the aforesaid shekels, be honest in making his returns and able to retire at night with a clear conscience and an unruffled temper.

I may add here that the collection department is of all departments, the most important. The results of its work are felt all along the line—the man who furnishes raw material, those who manufacture, the manager and the every day clerk and laborer are all dependent on the successful management of the collection department, to say nothing of the men whose capital is invested in the enterprise.

Gas Versus Electricity.—One member says that in the ordinary business of his company he has found many instances where the consumers have given up the use of current for gas because of first cost and further because of the dependable conditions under which gas is supplied. The conditions are familiar to all of you and therefore need no explanation. Gas is always ready, always on tap, while a very slight tap will send electricity a glimmering.

With the pilot light attachment and self lighting air valve attachment, the instant lighting is equal to the electric switch. Another member relates an instance where a fire occurred in a two-story building, the lower part of which was occupied as stores. The stores were badly damaged; electric wires were severed and pulled down; the gas runs attached to the ceiling joists remained intact and several gas arcs hung on their drops. The glass globes of course were broken but the mantles hung in place and and the lamps were burning after the fire had been subdued; another evidence of the reliability of gas.

Accounting.—The following experience is the result of presuming:

In the regular way a closing statement was taken when occupants moved from a certain address. The closing reading showed, we will say, 289, and the meter was locked, which means the gas was turned off at stop cock. This was some time early in the month. When the meter was read at the regular stated time, it was returned as reading 334, thus showing a consumption of 4500 cu. ft. As the company had not been notified by any one, that the place was again occupied, this of course did not look right. Accordingly a man was sent out to investigate, with the result that he found the house occupied by a new party. This man obtained the name of the new occupant and at the same time took statement which showed the reading to be 289, the same as given at time meter was locked. The last statement shown in ledger that was just being closed was 334; was transferred to a new ledger as 334 and this statement coming in as 289, the bookkeeper made the account read 389, thus again charging the party 5500 cu. ft. or a total in the two transactions of 10,000 cu. ft., when as a matter of fact no gas had been used. The party was presented with the bill, but insisted that she had not used any gas. As this sort of statement is very common, it was not readily accepted, but the payment of the account was insisted upon by the collection department. Shortly after the presentation of this bill, at the request of the consumer, the meter was removed and the out statement showed 289, confirming the statement of the consumer that no gas had been used and confounding and confusing the management, collection, and the complaint departments, and all of this because of the presumption on the part of a bookkeeper. In a large concern where over seventy-five thousand accounts are handled every month, errors will, do, and are bound to creep in. This experience is given for the purpose of showing that nothing should be taken for granted. The consumer in this instance was a very reasonable person. The incident was closed quite satisfactorily to all concerned, yet through it all was an under current on both sides that all was not said and done strictly on the square.

Be sure you are right; then go ahead.

Guess work is good work when it hits; but it seldom hits.

This from a Chinaman:

July 9, 1913.

Mr. Gas Company.

Gentelmens:—You send me big bill one month; next month you send me little bill what fo! usem gas alle time same. I think he leak, some time smell velly bad. You sendem you partner down look, so he can smell and fix him soon, take him to your office.

Another:

Pacific Gas & Electric Company.

Dear Sir:—My room has been fire two weeks ago so I will get off from that place. I beseach to your kindly sent your partner to come to take the gas meter off as soon as you possibly please. But the deposit receipt was burned up by the fire Can you count him up so you see how much I ought to receive, so you can send it to me to Gum Lung. Well so long Good Bye.

Yours truly, CHANG YUEN.

This from a son of Nippon:

"Honorable Sir Mr. Gas Company I wish to leave not your meter in the house when I go because I will move to ———— street, so if you come now and count how I am to pay you this month, I will be much pleased to fix the honorable matter up so satisfaction will come to your Company and to

"'Yours very much respect, H. HONCHOH."

Personal Interviews.—From a member of the commercial department:

A young man was given a district where it was specially desired the consumption of gas should be increased.

This particular point was very effectually impressed on the commercial man, increased consumption is what you are working for. "Increased consumption it shall be if I can make it so," he said to himself. One day while talking to a prospective purchaser of a gas range, he happened to say, "I am working hard to increase the consumption of gas in this part of the city." "Oh!" exclaimed the woman, "that is why you are so anxious to sell me a gas range, is it? Well, you can just trot along young man. My bills are big enough already."

Moral: Keep ever in view the main object, but don't always tell the other fellow.

Another commercial man has this to say:

"I have charge of a district in which I am looking for new business, and incidentally giving considerable attention to complaints of consumers. One day during the past year I met a lady who had a sore grievance against the gas company, and it ran something like this: This woman had two meters located under the front steps of a two-story house. This two-story house was supplied through one of these meters. The second meter supplied a small bungalow on the rear end of the same lot. She had requested the removal of one of the meters on account of the two-story house being vacant. Accordingly a regular tag was made and in doing so the company number of meter was not given correctly. The result was the man removed the wrong meter and the woman was without gas to cook her evening meal. She telephoned to the company's office and the man was sent back to restore the meter. Now this woman had worked herself into a passion and by the time the man returned to correct the error, to use her own language, she was "good and hot." Accordingly she pitched into the meter man and over his shoulders, the whole management. The meter man, however, was mute—that is, he said nothing; offered no excuse; simply did his duty in restoring the meter to its proper place and after only a short delay, the woman was again supplied with gas. When I met this woman, it was several weeks after the incident here related. She was still "hot," not so much, she said at the gas being shut off as she was, at the fact that the man would not talk back and give any reason for the blunder he had made.

Now the facts in the case, I learned on investigation, were not with the meter man or with the meter department, but with herself. The front house had been occupied by Martin A. Smith, her father, who had died. Her name was Mary Ann Smith. On the company's books the accounts were carried as M. A. Smith, 419 ———— street, and M. A. Smith, 419½ ———— street. In giving the order for removal of meter she gave the number as 419½ instead of 419. Consequently the meter was taken out correctly as per her request.

This consumer is one of the kind of women that likes to talk. Of course there was a slight annoyance in having her gas shut off, but that was nothing compared to the lack of satisfaction because the company's man would not talk.

From a distribution department, I have an experience that caused considerable annoyance for both gas and electric workers. At an electric manhole it was noticed that every time there was occasion to open the manhole it seemed to be filled with gas and all the while men were at work it was a source of annoyance. Just where this gas came from was hard to determine. Finally it was noticed that on the sidewalk there was a drip pipe. It was also noticed that the iron conduit that ran from the manhole came up on the opposite side of the same pole. These no doubt had both been in use for many years without any trouble occurring. From the position of gas main, drip pot and manhole, and the nearby tracks of the electric railway systems, it is not difficult to determine what took place and how it was that gas got into the manhole and drove the electric man out.

The manufacturing end of our business seems to have reached a state of perfection as I have not received any experiences along that line. However, we all know that the use of California oils and improved generating systems have brought this branch of our business up to a standard that will be hard to improve upon. A member contributes the following which gives a little inside light on present processes:

A complaint came in from a house in ———— that a very bad smell was passing all over the house and a request was made that some one be sent out to look for a leak. The complaint was given immediate attention. A small leak was found at the inlet joint of meter. The woman of the house does her banking business with the Hibernia Bank and this is what she had to say about the manufacture of gas: "And so ye found a leak! did ye! and sure that is what has been making me bill so big! It rotten stuff ye are making and calling gas!" The man at once began to defend the method of manufacture and the quality of gas. "Oh, she said, don't talk to me, young man! I know all about it. Sure my old man works at the gas works and many's the time I have taken his lunch to him down there. He works in the putrefying room and I knows that ye uses ould nasty black oil and shavens, for my ould man do be working thim shavins, so he does." This of course explains the whole process of manufacture from the receipt of the oil in cars at the Works, until it finally passes through the purifying boxes ready to do its work for the housewife.

PANAMA-PACIFIC ELECTRICAL DISTRIBUTION SYSTEM.

An extensive system of mains for the distribution of electric light and power to all the structures of the Panama-Pacific International Exposition has been devised and is now nearly completed, under direction of G. L. Bayley, member American Institute of Electrical Engineers and American Society of Mechanical Engineers, chief of the exposition's department of mechanical and electrical engineering, assisted by L. F. Leury and by Henry Bosch, both members of the American Institute of Electrical Engineers, while the Bureau of Illumination is in charge of W. D. A. Ryan, who was responsible for the excellent illumination at the Hudson-Fulton memorial celebration in New York.

In the main exhibit palaces light will be furnished from 60-cycle, 3-phase, 4-wire mains, having a voltage of approximately 115 between conductors and neutral. The lighting in the other districts, those for concessions and for State and foreign buildings, will be served from 60-cycle, single-phase, 3-wire mains, having a voltage of approximately 115 to neutral and 230 between outside conductors. For power throughout the grounds, 60-cycle, 3-phase and single-phase service at 230 volts, will be available. In addition to alternating current service, there will be mains installed in the Palaces of Machinery, Transportation, Manufactures and Mines and Metallurgy for the distribution of direct current at 125 and 250 volts.

Wattage for patrol, janitor service and lighting of main exhibit palaces was figured on the basis of one-tenth watt per square foot of building area. To this amount has been added an amount estimated to be sufficient to cover the requirements of motors, booth lighting, incandescent decorative lighting and lighting of detached buildings. In the states and foreign government sections the load was based on one watt per square foot of building area, with the building area taken as two-thirds of the total ground area of this district. The average peak load demand of this district, including the live stock exhibit, was taken at 2000 kw. The probable demand of the concessions district has been assumed at 2500 kw.

For the direct current power service in the Palaces of Machinery, Manufactures, Transportation and Mines and Metallurgy, a total of 1000 kw. has been allowed. Direct current service is comtemplated only when the nature of the apparatus absolutely requires it.

THE INDUSTRIAL FUEL SITUATION.

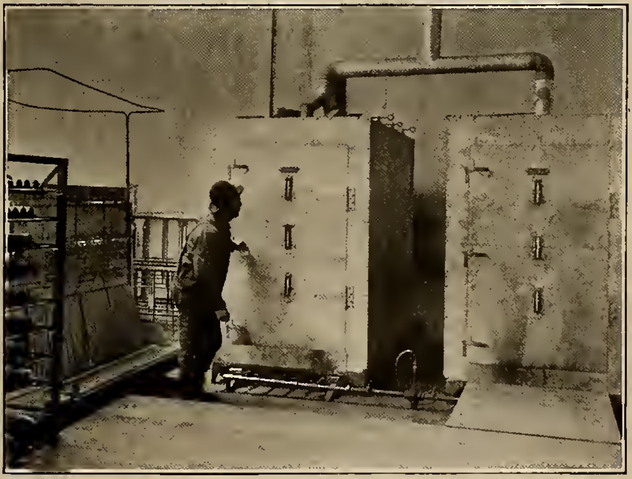
Why Gas Companies Should Handle Industrial Appliances.

BY JOHN B. REDD.

(This paper was presented before the Pacific Coast Gas Association convention, 1913. The author shows that the sale of gas for industrial fuel purposes is of greatest importance, but as the profit on the sale of the appliances is too small to permit of expert selling on the part of the dealer, the most logical solution is that the gas company handle these in the interests of all.—The Editor.)

Those members who attended the 20th annual convention of the Pacific Coast Gas Association at San Diego, and had the pleasure of hearing Prof. C. L. Cory present his splendid paper entitled "Reasonable Gas Rates" no doubt remember the comparative figures given on the operating expenses of two gas companies in different cities. The daily capacity of these two companies was the same, but the total output of one was practically double that of the other. The former, or more progressive company, could show certain returns upon the capital invested at a rate per thousand cubic feet of gas, which would be absolutely prohibitive to the latter. Prof. Cory stated that for both the stockholders and consumers to derive the greatest benefit from a plant, it would be necessary for the gas company to increase the output in every possible manner, and that he believed the largest increases would come from the correct installation of industrial fuel appliances by the gas companies.

Tempering Furnaces; Temperature 1400° F.



Japanning Ovens Gas Heated to 260° F.

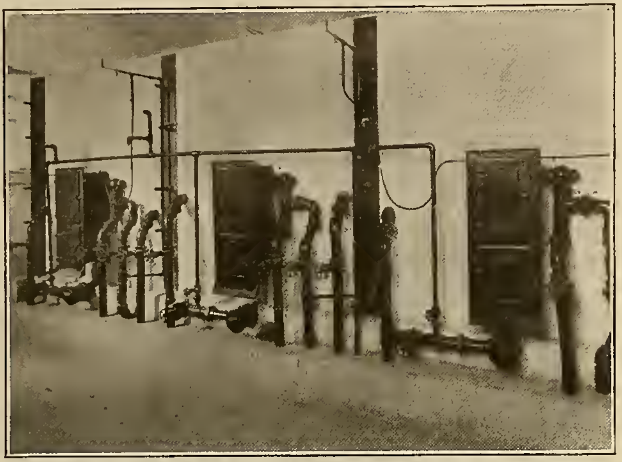
Particularly is this true of the public utilities operating in the Pacific Coast states, where conditions are somewhat different than in other sections, due to the presence of crude oil, a powerful competitor backed by the brains and capital of the oil companies, as well as the oil burner people. The manufacturers of oil burning apparatus are indeed a "live bunch," and are continually improving upon their burners and appliances. Their agents operate in the small towns, as well as the large cities, and find the game comparatively easy where the gas companies fail to go after the industrial fuel business which rightfully belongs to them, and which is awaiting the "live wire" gas salesman. Ripe fruit will rot before your very eyes if you sit in an easy chair and do not go after it. Such is the case with what might be good gas business today, but tomorrow belongs to the oil salesman because of his progressiveness.

Certain business rightfully belongs to the oil people, but I might say that much business which belongs to the gas companies is now in the hands of their competitors. It is up to the gas fraternity of the Pacific Coast states to go after the industrial fuel business and go after it right. We cannot depend upon the appliance dealers to sell industrial appliances and increase our business, as they are only familiar with a few of the appliances and cannot afford the time necessary to make the experiments or tests to secure profitable business. It is often the case that a ten or fifteen dollar burner properly installed will bring in more revenue for the gas company, and give to the consumer results equal to an appliance costing may times that price, but what would be the object of a dealer not directly interested in the gas company endeavoring to sell a burner for a few dollars when there is a possibility of inducing the prospective buyer to purchase a high priced appliance on which the dealer makes a fair profit.

An industrial fuel engineer must necessarily make up special burners or assimilate a combination of burners for a large portion of business obtained. To secure this class of business, the burners must be sold at a reasonable price, and this cannot be the case when the amount charged is figured to offset the cost of labor, material and the salesman's time, all of which must necessarily be added to the sale price by any appliance dealer other than the gas company. Many times a burner of special design is made up for a particular job and the exact style never made use of a second time. To obtain proper results from this end of the business, the gas company, especially in large cities, must maintain an up to date industrial department composed of good salesmen familiar with combustion, ventilation and the various other features necessary in the sale of appliances and the proper operation of same, men who are well up in general manufacturing technique, in position at all times to hold the attention of the prospective consumer, and to give correct information in converting the appliances from other fuels to gas. These men will have to know wood-working, foundry and machine operations, the working of fabrics, the hotel, restaurant and bakery business, the routine of city work, and in fact all classes of businesses. They will have to keep awake twenty-

four hours per day to think of the many new usages for fuel gas.

When a new salesman for the industrial department is needed, select an enthusiastic young fellow from some other department of your company. Encourage him in the work and make him feel free to ask any questions whatsoever pertaining to the business. Each new man should specialize on standard appliances and burners possible to be used by certain classified business until he is not only familiar with the appliances, but is also thoroughly acquainted with the operating details of such business upon which he is working. His work should be changed every few



Mount Olivet Crematory Retorts.

months, or as often as the head of the department deems advisable.

The success of an industrial department depends largely in securing the willing co-operation of all of the departments, and the individual support of each employe of the company. This can be accomplished by attending meetings and giving demonstrations of new appliances to all employes, especially those who come in direct contact with the public as representatives of the company, impressing upon them the fact that it is to their own advantage to familiarize themselves with the various appliances. With employes at all times "boosting" gas as a fuel to their friends and acquaintances, many prospects will be found who otherwise would have purchased coal or oil appliances before the industrial department knew of their intention of going into business. The fuel question is interesting to almost everyone, and can be made a live topic of conversation in any company.

There are many manufacturers of fuel appliances, and much care should be exercised in the purchase of same, as money can be saved, both for your company and the consumer. Before new fuel appliances are purchased a thorough understanding should be had with the manufacturer as to the maximum gas consumption per hour and temperatures obtainable. Moderate prices and first-class workmanship should be insisted upon at all times. Many fuel appliances are sold direct to the user by the manufacturer, or through a local agent; neither of these methods are very satisfactory, as a manufacturer has to depend upon unreliable information by letter, and often the agent is unfamiliar with the appliances he is handling, the natural results being a dissatisfied gas consumer and the sale of other gas fuel appliances made more difficult. Relieve the manufacturer of direct sales, and the gas companies will not only profit by being able to purchase first-class appliances at reasonable prices, but the manufacturer will employ additional engineers who will design new types of appliances and increase the efficiency of the old ones to an extent that gas will become recognized by the general public as the best and most economical of fuels.

It has been said that there are no great manufacturing concerns, such as the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Company to prod

Two Blast Bake-Oven Burners.

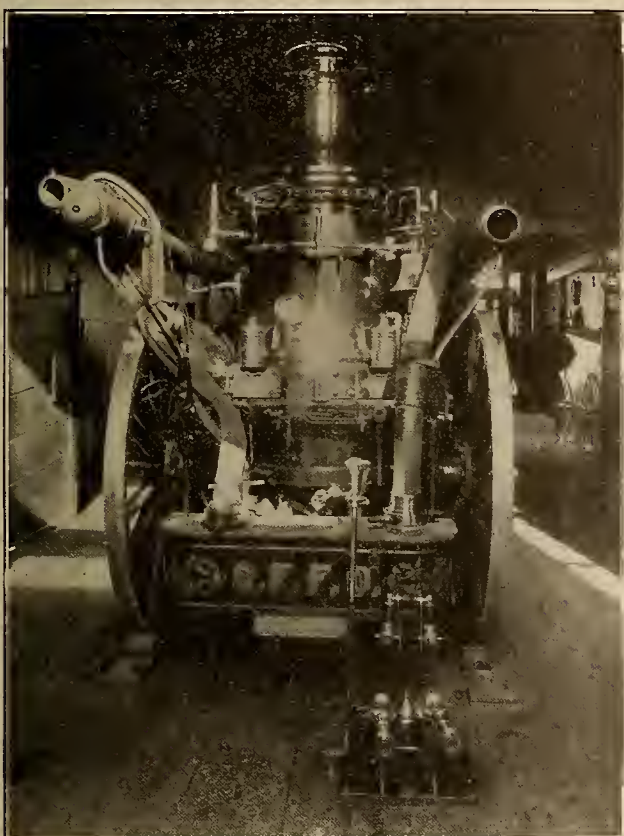
and stimulate the resourcefulness and ingenuity of the promotion department of gas companies. Why is this the case? Because we who are in the gas business have failed to do our utmost in the development of our field. This is clearly demonstrated by the fact that many of the most successful gas appliances now in use have been invented by men other than those in the gas business. Technical training among gas

Gas Burners Used for Varnish Manufacture.

companies has been confined almost entirely to the construction end and to the manufacture of gas. The promotion of sales has been left to men whose whole training has been in the gas business, and who have always heard of ranges and arc lamps, and those things have become the routine of their lives. Let the gas companies spend as much money, energy and earnest-

ness in going after the industrial fuel business as they have in domestic promotion, and every account taken on will pay many times the profit that the company has been accustomed to. The cost of carrying a large account on the ledger is no greater than a meter rental account, less trouble is experienced in collecting the bill and the additional investment in larger meters and services is negligible in comparison with the revenue derived.

The maintenance or up-keep of appliances is a vital feature in assuring constant and satisfied users of gas for fuel purposes, and each installation should be inspected every sixty or ninety days. The cost of maintenance will be more than offset by the sale of additional appliances, besides the consumer will appreciate the attention sufficiently to become a booster for the company and willing at all times to demonstrate his appliances to prospective buyers. Such demonstrations, backed up by a good word from the user, as to results and gas service, will, nine times out of ten, cinch the sale. It would be absurd to think of a dealer properly maintaining appliances without making a profitable charge for the work. The best that some of the dealers give is a defective material guarantee on standard appliances for one year, which is of trifling value to the purchaser as an appliance that cannot be guaranteed for a much longer time than a year should not be recognized as a first-class article by the gas company's representative.



Connections and Gas Burners for Fire Engine.

With the industrial department working in harmony with the manufacturing and distribution departments, and reporting dead meters, choked services, etc., a better gas supply and a more uniform pressure is assured the consumer, which is very necessary to secure proper results from appliances. There may be a sufficient gas supply on the mains at all times, but unless the service fuel lines and meters are of proper size, many poor pressure complaints will be received daily. Complaints of such nature are often handled by inexperienced men working under orders from the foremen to do certain work as quickly as possible and go on to the next job. If the order reads "pump service," the complaint man pumps the service often giving only temporary relief, whereas if he were an experienced appliance man familiar with the capacity of meters and different sizes of pipe, he could advise changes which would give permanent relief and good service. As we cannot afford to have experienced appliance men handling all complaints, it is necessary for the industrial department to keep in close touch with all large fuel installations and to correct any trouble before the consumer becomes dissatisfied with the service. Confidence in gas as a fuel is shown by the gas company handling industrial appliances, and in promotion confidence means the proposition quickly and successfully accomplished. How much more forceful are the arguments of the industrial salesman when he can bring his prospect into a first-class display room and actually demonstrate the gas furnace desired, than when his stock in trade consists of a lot of nerve and a bunch of catalogs. Catalog sales require twice as long to be made, and in many cases by the time the appliance arrives from the factory the purchaser has decided that the old coal or oil furnace is good enough and you have a customer in a much more antagonistic frame of mind to the salesman and the gas company than when he was first approached.

Can we expect the prospective buyer to become enthusiastic over catalog cuts and descriptions of expensive appliances; such as tempering, annealing, tinning, crucible, bronzing, carbonizing, muffle and other types of furnaces, japanning, enameling, drying, sherardizing and bake ovens, rivet heaters, brazing tables, tire and house heaters, branding irons, sterilizers, steam boilers, tool forges, gas engines, butchers' kettles, candy furnaces, batch warmers, incinerators, vulcanizers, water stills, glass and china kilns, industrial burners, and the hundreds of other appliances unfamiliar, not only to the industrial world, but to the majority of gas men. Go yourself into the gas appliance stores and see what information you can obtain upon the appliances mentioned, and then answer the question, who should handle industrial fuel appliances?

For further proof as to the value of an industrial fuel department, I take the liberty of calling your attention to some of the work accomplished by the Industrial Department, San Francisco District, Pacific Gas & Electric Company, since its organization two years ago:

Average Daily Gas Consumption from Industrial Fuel Installations.

	Cu. ft.
75 brick bake ovens converted from wood and oil to gas	90,000
45 fire engines	40,000
Hotel ranges, broilers and restaurant appliances	80,000
Blow torches, soldering furnaces and small blow forges.	25,000
27 gas fired steam boilers totaling 98 h.p.	35,000
Tempering, annealing and case hardening furnaces	20,000
Gold, copper, aluminum and soft metal furnaces	47,500
Japanning, enameling and core ovens	22,500
Special burners, house heating and miscellaneous appliances	118,000
Total daily gas consumption	478,000

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advtrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Long Live Competition

With the streets of our cities packed with enthusiastic baseball fans, watching the progress, by bulletin, of the world's series, someone startled us with the statement that competition is dead. The comparison is not irrelevant though the one event was in the realm of sport and the other in the camp of the captains of industry. Ask the merchant or average business man about the matter and he will either smile that it "never was keener," or if he has passed that stage, and got onto the wrong track, may but grit his teeth and snap, "Fierce!" Do you mark that line of applicants for the job, though but one man is needed? Ask the rest, whether competition is dead.

Three factory representatives start off on an automobile race from Seattle to San Diego, or somewhere else. At the commencement each has an understanding: Whatever the reason that delays one, the others will co-operate with him in assuring a dead-heat at the finish by being equally delayed. The result is that the "race" degenerates into a turtle trot and the promoters, who may through necessity be the public, bring machines (maybe foreign trade let in by a tariff) from other parts, that the race may be at least interesting to those who pay. Co-operation erroneously took place at the point where competition should have commenced.

Let the same three motorists co-operate at the outset in producing each the best machine that his factory can manufacture and then run their competitive race and it will prove interesting to the public, demonstrate the merits of each machine, and show also whatever of originality or individuality each design possesses. That puts both co-operation and competition in their proper place.

Co-operation should obtain in the perfecting of product and the extension of markets, and competition in the marketing of that product both now and always. Competition far from being dead, is very much alive, and it is well that it is so, for that way lies good business and a nation's prosperity.

In competitive effort, many strive, but one only receives the prize. But here our analogy, like all analogies, proves weak, for in the world of commerce there are many things which appeal to a customer when awarding business. The lowest bidder often fails where quality, individuality, standing or utility succeed, and so on.

We may co-operate to make competition legitimate. It is not legitimate to undersell or otherwise harrass a successful competitor, at the expense of character or with financial loss. Where competition among weak men has caused cut prices, it is found that they are swiftly self-destroyed who fail to realize that the first principles of business demands a fair profit on each transaction.

Competition also eliminates the sluggard, and viewed rightly makes for business, health and acuity.

Competition is a condition, co-operation is different. The spirit of co-operation in business is altruistic, for it implies both giving and receiving. It means that competitors even, tell each other the how, why, when and where of their accomplishment. Tell it without hope of reward and sometimes at an immediate sacrifice. It makes competition more keen, but robs it of its sting. If you have felt the sting of competition

in the past it is the result of wrong action—fighting your competitors instead of fighting for the business; but as long as human nature continues, so long will competition, for while co-opertion may make for a better understanding and basis, it is not business, but only a means to that end.

Persistent over-production is a result of mismanagement and is not a legitimate excuse for centralization or consolidation that prices may be raised to meet that condition. This is not co-operation and certainly will not kill competition. To produce to a point beyond the demand is to telephone for the receiver, unless through co-operation you create for that surplus a new market.

Educate the public, educate your sales force, and through quality, originality, the usefulness and individuality of your product, press right up to the front, and you will find pleasure in displacing the death dirge with the paen of promise: "Competition is dead! Long live Competition!"

The Point of View

Getting the other man's point of view is apparently as difficult in our time as in the days of knighthood. Two mounted knights approaching each other from east and west halted on the highway a few yards on either side of a suspended shield which indicated the name of mine host's inn.

"What a pretty silver shield," hailed he from the East. "'Tis gilded," said he of the West. "You are mistaken." And thereupon ensued an interesting discussion which ended in each riding at the other and due to the shock of contact they became unhorsed each in the place previously occupied by the other, and from this new view-point, each looking up at the shield, acknowledged he was wrong, for they had stopped at "Ye Sign of the Gold and Silver Shield," which was silver toward the East and gilded to the West.

Truly a thought is not our own until we tell it to another when it is either confirmed or confounded, but in either case, our own store of knowledge is enriched.

Depreciation

The subject of depreciation is admittedly of prime importance to the public utilities executive whether he desires the information in order to arrive at a satisfactory method of rate-making, or to justify, before a public service commission rates already made, in connection with which this factor looms so large.

Invention which causes plant reconstruction and replacement long before the old has worn out that the company may give better service or produce with increased efficiency, makes it well nigh impossible to estimate this item with precision. There seems to be a myriad other factors which enter also, and different angles from which to view each of these that may be properly interpreted.

The statistical estimate is a scientific procedure which looks to the constancy of laws for its accuracy, but in the gas and electrical industries progress with its unceasing change is also constant and the statistical determination of some items is almost impossible. This is especially true of the item of depreciation.

It is equally difficult to apply the same laws of depreciation or obsolescency to places of different geographical location. For example, to a place where an abundance of natural gas has been discovered as compared with that depending upon perpetual coal, or again, to that place where coal has been displaced by oil in the manufacture of gas. Then again the destruction of plant and property through fire or the forces of nature might also enter to disrupt the most carefully made estimates of depreciation; and such cases might be multiplied.

Public utilities should be permitted to carry a sufficiently large reserve fund to care for contingencies, but when this has been done, and chance eliminated as far as can be, there must still obtain a theoretical basis closely approximating the actual which may be used in arriving at a proper conception of depreciation and similar items obscured in the maze of counter considerations of high finance.

Much valuable work has been done by Dr. Alex. Humphrey, whose papers presented before the Pacific Coast Gas Association and the British Gas Institute are appearing in this issue, in arriving at just what factors enter into a discussion of this subject and the best methods of determining what the item of depreciation actually is.

The Cost of Service

The successful laying of the Gulf of Georgia submarine telephone cable, described in this issue, added another world-beating record to the credit of the Pacific Coast. The cable is in deeper water than any other continuously loaded telephone cable, and at its greatest depth, 1380 ft., the pressure is nearly 600 lb. per sq. in.

Telephone experts the world over watched with great interest the laying of this cable, for it is the longest submarine telephone cable of its kind. The principle of the system in use on the new cable was discovered by Krarup, a Danish telephone operator. The installation is said to be entirely successful.

Those who tried to speak over the now displaced cable and land line will appreciate the value of this new cable purchased and laid by expert engineers as compared with the old "telegraph" cable which it was stated was bought in the open market by one of the directors. Of course, the art has progressed also, and much credit is due the directors of the British Columbia Telephone Company for the spirit in which they discarded the old line and installed such an excellent new one, in order to give better service.

The expenditure of a quarter million dollars for improved service does not impress us as it should, for familiarity is breeding an indifference to the meaning of figures and the immensity of amounts.

We read indifferently that $55,000 is to be spent for a short underground conduit system to replace an aerial which a fastidious public has condemned, $60,000 to be expended for rebuilding 23 miles of toll line between two cities to increase efficiency and then $250,000 for the Gulf of Georgia submarine telephone cable in order that better service be secured. As public utility improvements go, these amounts too are comparatively small.

As already stated, service is the incentive to this expenditure which, however, stands also for progress, increased profits, and greater satisfaction to all.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. E. Plank, General Electric Company, Seattle, is on a trip East.

Miles F. Steel, Benjamin Electric Manufactnring Company, is at Spokane.

J. O. Presbey, Holophane Works of G. E. Co., was at Salt Lake City during the past week.

Mortimer Fleishhaker, Great Western Power Company, has left for a trip throughout the East.

A. P. Peck, Electric Supply Company, Sacramento, was at San Francisco during the past week.

Wm. Bromley, manager Ukiah Electric System, was a visitor at San Francisco during the past week.

E. C. McBrearty, Detroit Electrical Heater Company, is at San Francisco and will also make other coast cities.

T. L. Nightingale of the Electrical Supply Company, Sacramento, has returned from a six weeks' business and pleasure trip to New York.

Sylvester A. Baker, McBeth, Evans Glass Company, is at Portland, Ore., and will visit other northwest and British Columbia cities.

Ralph Phelps, the Safety Insulated Wire Company's popular representative, excelled at the Portola Festival as Vasco Nunez de Balboa.

J. V. Schneider of the Western Electric Company, San Francisco, recently returned from a several day's business trip through Northern California.

Hugh McPhee, electrical commercial superintendent, and **L. Mesmer**, plant superintendent of the Western Union Telegraph Company, were at Yuma recently.

L. C. Helfrich, purchasing agent, Coast Valleys Gas & Electric Company, has returned to the head office after having visited the branch offices of the company.

W. H. Trask Jr., commercial agent, Idaho Railway, Light and Power Company of Boise, Idaho, is a Salt Lake visitor on his way to Denver, where he will take a short vacation.

J. T. Ryan, valuation engineer, J. G. White Engineering Corporation, was at Santa Barbara and gave expert testimony in re the case of the Santa Barbara Gas & Electric Company.

J. E. Stevenot, Philippine General Electric Company, was at San Francisco last week, having returned from an extended trip through the East. Mr. Stevenot will return home via British Columbia.

Col. H. V. Carter, president Pacific States Electric Company, **T. E. Bibbins**, manager General Electric Company, San Francisco, and **Mr. Lillard** of the Gould Storage Battery Company, are taking a vacation motoring.

W. F. Cozad, a director of the Colorado Electric Club, was a visitor at the Thursday luncheon of the Utah Electric Club. At the request of the chairman, Mr. Cozad outlined briefly the work of the Colorado Club and their experience in various matters.

Frank W. Loomis, sales manager electrical department H. W. Johns-Manville Company, Seattle, has been appointed to take charge of the Illuminating Engineering department of the company at Milwaukee. Mr. Loomis was previously connected with the Holophane Works of General Electric Company.

Wm. C. Beatty of the United States Reclamation Service, electrical engineering department, on the Rio Grande project, in New Mexico, is at Los Angeles. Mr. Beatty was formerly connected with the Tracy Engineering Company of Los Angeles.

D. R. Kennedy passed through San Francisco en route to Riverside, Cal., where he will occupy the position of superintendent of power houses for the Southern Sierras Power Company. Mr. Kennedy was previously with the British Columbia Electric Railway Company at Vancouver, B. C., and had charge of the high tension system.

Andrew N. Fox, who is conducting a 20 weeks' course in advertising at the Chicago, Y. M. C. A., is singularly qualified to make a great success of this course which is intended to give students a sound knowledge of the underlying princi-

Andrew N. Fox, Advertising Manager Benjamin Electric Co., Chicago, Ill.

ples being followed in the production of successful advertising. Mr. Fox is advertising manager, Benjamin Electric Manufacturing Company, a director Chicago Advertising Association, vice-president Central Division and member Board of Lecturers Associated Advertising Clubs of America.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The regular weekly luncheon was held at Tait's Cafe. An appropriate address on "The Life and Works of Edison," was read by Frank D. Fagan, lamp specialist, General Electric Company, San Francisco, the meeting occurring on Edison Day, October 21, 1913, the 34th anniversary of the birth of Edison's carbon filament incandescent lamp.

San Francisco Chamber of Commerce.

As the guest of the San Francisco Chamber of Commerce, the local Electrical Development and Jovian League attended a smoker at the Commercial Club on October 20th. The feature of the evening was an address on "Co-operation," by Mr. Edward C. Trefz, field secretary of the Chamber of Commerce of the United States of America. Mr. Trefz is a speaker of rare merit and his excellent address further ensured the success of the meeting. Other speakers were Frederick Whitton, Col. Geo. H. Pippy, Wm. R. Wheeler, Geo. I. Chase, F. B. Conley, Frederick J. Koster.

Utah Electric Club.

At the regular Thursday luncheon of the Utah Electric Club, Malcolm McAllister, advertising expert, discussed the subject, "The Salesman—the One Best Advertisement." Mr. McAllister claimed that few printed ads really sell the goods. The best a printed advertisement can do in general is to attract attention and arouse a desire to purchase. In most cases the deal must be closed by the salesman. If the sale is not made right, it is often not made to stay, so that the improper selling methods may undo all of the work of an expensive advertising campaign. On the other hand, proper selling methods co-operating with an intelligent aggressive advertising campaign form the best business getting team.

Portland A. I. E. E. and N. E. L. A.

The Joint Committee of the local section of the A. I. E. E. and N. E. L. A. has arranged an interesting program for the ensuing season. Papers will be presented by B. C. Condit, chief electrical engineer, Northwestern Electric Company, by O. B. Coldwell, superintendent Light & Power Department, Portland Railway, Light & Power Company, by P. Lebenbaum, electrical engineer, Portland Railway, Light & Power Company, on "Railway Electrification," and by F. D. Weber, electrical inspector, U. E. R. Bureau, on the question "Is it necessary to have Underwriters' Inspection in Oregon?" The fol-

lowing papers have also been prepared: "Outdoor Substations," by D. F. McGee, electrical engineer, Pacific Light & Power Company; "Hydroelectric Development," by L. F. Harza, consulting engineer, and on "Fault Location," by H. M. Friendly, electrical engineer.

"The Principles and Phenomena of Wireless Transmission," by Prof Elihu Thomson, "Electricity in the Construction and Operation of the Panama Canal," D. B. Rushmore, and a lecture by Ralph D. Mershon on "Some Things Engineers Should Know concerning the Rudiments of Corporation Finance," available from the lecture bureau of the National Electric Light Association will also be given.

The active committee members in charge of this program are F. M. Friendly and W. H. Evans, representing the A. I. E. E., R. H. Fisher and J C. Martin, representing the N. E. L. A., and E. H. Le Tourneau connected with both associations.

Eleventh Jovian Congress.

The eleventh annual meeting of the Jovian Order was held at the Hotel Astor, New York City, October 14th to 16th. In many respects it proved one of the most momentous yet held, largely because of certain changes in scope which should greatly enhance the practical value of the organization to every member. Over one-fourth of the entire membership of twelve thousand was represented in person or by proxy, which insured the election of W. N. Matthews of St. Louis as twelfth reigning Jupiter.

The convention was opened on Tuesday morning, October 14th, with Statesman Jos. F. Becker in the chair, to introduce Jupiter Frank F. Watts, who delivered a graceful address of welcome. The response was given by H. F. MacGregor, Past Jupiter No. 2, after which Jupiter Watts called Henry Harris to preside over the remaining business sessions. As those were devoted largely to matters not to be revealed to the uninitiated, only a brief summary of some of the results can be published.

The report of Mercury E. C. Bennett showed that all previous records for increase in membership had been surpassed during Jupiter Watt's administration, over 3800 new members having been admitted during the past year, giving a present net membership of 11,587. The best individual record was made by Statesman Frank D. Beardslee of St. Louis with a total of 466, of which 285 were in one class, the largest single class on record. Mercury's report contained a series of valuable suggestions, most of which were adopted.

Of these the most vital is the establishment of a commercial division of the central office under the management of E. C. Bennett, who will also supervise the social division. The purpose is to devise ways and means whereby the local Jovian Leagues can accomplish more practical work of direct benefit to the electrical industry. Co-operative electrical display rooms are to be established, an employment bureau maintained, speakers to be provided, better legislation is to be fostered, co-operation of architects to be secured, and similar plans to be fixed by the twelfth congress.

A new district was established in Canada and the office of Triton instituted to provide an additional Congressman. The former method of voting by states instead of by proxy was adopted, a new degree of Stentor prescribed and important changes made in the ritual. Hereafter Jovian Day will be celebrated on the third Tuesday of September and university students in electrical engineering may be admitted.

At the annual election of officers on Thursday morning the report of the nominating committee was unanimously adopted and the following members of the Twelfth Jovian Congress elected:

Jupiter, W. N. Matthews, St. Louis, Mo.
Neptune, M. F. Knapp, Pittsburg.
Pluto, Tom Bibber, New York City.
Vulcan, A. H. Halloran, San Francisco, Cal.
Avrenim—L. V. Noguira, Dallas.
Hercules, Geo. C. Rough, Toronto, Canada.
Mars, E. A. Wilcox, Boise, Idaho.
Apollo, Geo. C. Richards, Chicago.
Triton, M. H. Jones, Baltimore, Md.
Mercury, E. C. Bennett, St. Louis, Mo.

The following Chief Stentors were also elected: Tom Bibber, H. H. Cudmore, Perry Boole, Sam A. Hobson, H. E. Sanderson.

Degrees of merit were awarded to many members, including all Pacific Coast statesmen and statesmen-at-large.

At the Co-operative Session on Thursday morning Chas. L. Eidlitz gave a straight-from-the-shoulder analysis of the troubles in the electrical business, which he claimed is not ordinarily conducted on the strict principles as regards price and credits as in other industries. Henry L. Doherty, president of the Society for Electrical Development, told of the aims and efforts of this organized plan "to do it electrically." Papers were also read by Jas. H. Collins and Dr. Lee Galloway. Wednesday's entertainment features included a Jovian Lunch, the competitive degree team work and the annual rejuvenation. Two teams entered the competition, that of the National Carbon Company from Cleveland under Statesman M. H. Moffett and that of New York, under Statesman Jos. F. Becker. The committee of Past Jupiters finally awarded the prize to the excellent work of the New York team, also giving most complimentary notice to the work of the Cleveland team.

At the annual rejuvenation nearly 200 candidates were admitted. The New York team introduced a novelty by appearing in dress suits instead of the usual costumes. The ceremony was followed by a smoker and supper with vaudeville entertainment, all given by the New York Edison Company.

The annual banquet on Thursday evening in the grand ballroom of the Hotel Astor was one of the most magnificent affairs yet given by the Jovians. The elaborateness of the appointments was exceeded only by that of the menu and too much credit cannot be given to the committee having it in charge. As the cigars were produced the ladies were admitted to the balcony so that they also might enjoy the feast of reason which followed. This feature of admitting the ladies was but the culmination of the continual round of entertainment provided for them. Lunches, automobile rides, theatre parties, dinners and other entertainment was provided so that every moment of their time was occupied.

Portland Electric Club.

"Mike" Conley, a veteran trackman of the Portland Railway, Light & Power Company, and Franklin T. Griffith, president of the company, marched arm-in-arm at the opening meeting of the Electric Club and occupied seats assigned for those who had served the company for 20 years or more. They were followed by 53 others. The assembly hall was filled with some 300 members. F. D. Hunt acted as chairman. A unique form of presenting those who had seen long service in the company was adopted. All belonging to the 20-year class were placed in an anteroom and when the members were seated the honored guests were marched to the platform in pairs. When the 55 honored guests had been seated, a drop curtain was lowered along the wall having printed on it in large letters, "Twenty Years of Service." The orchestra played "Auld Lang Syne" with the audience joining in. It was an impressive scene and the cheers betokened the feelings of all.

A stereopticon showed pictures of the early period of Portland. There were views of 1851, 1856, 1877, 1885, 1890 and 1913, pictures of President Griffith as he looked twenty years ago and today. This was followed by scenes of early day streetcar operation in Portland. Pictures of horse cars conducted by Ben Holladay, the steam dummies of Sunnyside, Mount Tabor and Mount Scott, the cable line to Portland Heights, and then the obsolete trolley with finally an up-to-

date pay-as-you-enter car, which is in use today. There were, besides many old-time scenes, wherein the employes figured as participants, such as the flood of 1894, the wreck of the Nineteenth and Washington street barns and the Vancouver ferry.

C. F. Swigert, former president of the City & Suburban Railway, gave a brief address. He declared that streetcar operation in the early day was fraught with many disappointments and very few rewards. Pioneers in this particular line of endeavor lost money readily enough and furnished transportation at less than it cost when all factors were taken into consideration. The development, he said, was entirely too fast to deliver a profit for the reason that machinery was discarded before its usefulness was entirely gone, to make room for a more efficient and more recently invented machine. He told of the day in crossing the river long before the bridges were found to be a necessity and how the swamps which have long disappeared from the east bank of the river formed an almost impassable barrier to construction of railways connecting the east and west sides.

Franklin T. Griffith, president of the company, devoted some time to recalling the rapid changes in equipment which had taken place in a very brief time. "While the changes in the early period were fast and furious they were as nothing compared with the changes which came with the application of electricity as a means for motive power," he said. "The junk heap today testifies to the rapid progress of this industry. Much of it represents an investment, which came as the result of blazing the way for an up-to-date transportation company. All of the machinery discarded to make room for newer and more effective pieces is represented by capital investment and is only part of the burden which falls on all business alike in the effort to establish a paying concern, and leads to the conclusion that there are many things to be considered outside of the bare physical value of a plant. The transportation system of Portland and its electric lighting was only made possible by the work of Swigert, Campbell and Fuller in the railroad line and Eastman, Morey and Goode in the electric line."

F. I. Fuller, "Mike" Conley, Fred Cooper, O. B. Coldwell and A. H. Richmond gave brief addresses, after which the members partook of refreshments.

American Institute Electrical Engineers.

At the regular monthly meeting of the board of directors of the American Institute of Electrical Engineers held in New York on Friday, October 10, 1913, at 3:30 p. m. President Mailloux was authorized to change the organization of the Electric Power Committee by substituting for the subcommittee on prime movers, a committee on power generation, and to make the committee on prime movers an independent committee. President Mailloux announced the following additional committee appointments: Power Generation: H. W. Buck, chairman; Allan V. Garrett, F. G. Gasche, Daniel W. Mead, S. D. Sprong. Committee on Technical Lectures: W I. Slichter, chairman; W. A. Del Mar, secretary; W. S. Rugg, L. T. Robinson, John B. Whitehead. Committee on Engineering Co-operation: William McClellan, chairman; H. H. Barnes, Jr., A. W. Berresford, Charles E. Scribner, S. D. Sprong.

Upon the petition of the Panama members of the Institute, and the recommendation of the sections committee, authority was granted to organize an Institute Section in the Canal Zone, to be known as the Panama Section.

In response to an invitation from the National Conservation Congress, the president was authorized to appoint five delegates to represent the Institute at the Fifth National Conservation Congress, to be held in Washington, November 18-20, 1913

Upon the recommendation of the executive committee of the International Electrical Congress, President Mailloux was authorized to recognize the executive committee with a chairman and vice-chairman, with the several members of the committee, serving also as chairman of the necessary sub-committees. The personnel of the committee as reorganized will be announced later. The executive committee of the committee on organization of the International Electrical Congress, San Francisco, 1915, reported that it had unanimously decided to invite Dr. Charles P. Steinmetz to accept the position of honorary president of the congress and Dr. E. B. Rosa to accept the position of honorary secretary of the congress. This action was unanimously approved and confirmed by the board of directors.

TRADE NOTES.

Mr. Van E. Britton announces the removal of his office to room 501 Grant Building, Market street, San Francisco.

The following are among recent orders received by the Westinghouse Electric & Manufacturing Company:

S. S. Bullis, Medford, Ore. One synchronous motor generator set consisting of 600-volt, D. C. generator and 2200-volt, 3-phase, 60-cycle synchronous motor with one switchboard for the control of same.

Oakland, Antioch & Eastern Railway Company, Oakland, Cal. One 750-k.w., synchronous motor generator set consisting of two 650-volt D. C. generators connected in series, and 11,000-volt, 3-phase, 60-cycle, 514 r.p.m motor with direct connected exciter.

It is estimated that between 400 and 500 electric vehicles are in service in or within a short distance of Los Angeles. Quite a number of these are equipped with Edison storage batteries. This is particularly true of the commercial vehicles, one of the large power companies having twenty commercial electrics in regular service, all of which, so equipped, operate at a cost of 50 per cent or better in saving over that of gasoline cars in similar service.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

A decision was rendered granting authority to A. A. Weber to sell to the Alta District Gas Company a gas plant serving the cities of Dinuba and Reedley, and authorizing the gas company to operate under franchises in Tulare and Fresno counties. The company was also authorized to issue $20,000 of notes.

The San Rafael and San Anselmo Valley Railway Company applied for authority to issue $10,000 in stocks and $100,000 in bonds for the purpose of new construction.

Authority was granted to George W. Kitchen to sell his gas plant in Madera to the Madera Gas Company. The Madera Gas Company was given permission to issue $25,000 of bonds and $14,000 of stock.

The Tulare County Power Company was granted authority to issue $250,000 of notes and $33,000 of stock for the purpose of liquidating the company's indebtedness.

A decision was rendered granting authority to the Fresno-Hanford & Summit Lake Interurban Railway Company to issue $225,000 of stock.

The Hemet-San Jacinto Gas Company was granted authority to issue $3,000 in bonds for the purpose of purchasing new machinery.

Henry P. Kyes was granted authority to sell his water system to the city of Riverside for $15,000.

The Riverside Artesia Water Company was granted authority to sell its water system to the city of Riverside for $195,000.

The Commission issued a general order directing all steam and electric railways of the State to provide sanitary individual drinking cups for passengers at a cost not to exceed one cent per cup. These cups must be provided on all trains whose schedule between terminals exceeds one hour and thirty minutes.

NEWS NOTES

FINANCIAL.

WOODLAND, CAL.—Articles of incorporation of the Winters Gas Company have been filed in the office of the county clerk. The purposes as stated are to build, own and equip a gas plant, and to distribute gas to the town of Winters. The incorporation is for $50,000, stock being of 5000 shares of a par value of $10 each. The incorporators are: C. A. Erwin and Allen Stark of Winters, and W. W. Collins of Woodland, each of whom has subscribed for five shares of stock.

LOS ANGELES, CAL.—To pay the interest on the securities issued in connection with the Big Creek development, the Pacific Light & Power Corporation requires $650,000 a year. The company is now earning sufficient to provide for this interest and leave a balance of $175,000. This balance would be enough to also pay the interest on the $2,388,000 six per cent bonds of the Southern California Gas Company, which are paid by that corporation, a subsidiary of Pacific Light & Power Corporation.

ILLUMINATION.

GALLUP, N. M.—People's Light & Power Company has been granted a franchise to furnish electricity for power, heating and lighting purposes to town of Gallup and residents.

ALBANY, ORE.—G. L. Rauch of Portland has been granted another gas franchise by the city council. The first franchise became void in default of the filing of the bonds within the time limit.

SAN FRANCISCO, CAL.—The Coast Valleys Gas and Electric Company has applied to the commission for authority to issue $114,000 of bonds. The money is desired to pay existing indebtedness of the corporation.

PORTLAND, ORE.—Rules have been issued by the Oregon Railroad Commission governing the installation by public utilities of gas, electric and water meters, the quality of service to be supplied and the charging of deposits to consumers.

ASHLAND, ORE.—H. G. Butterfield submitted a petition to the council asking for a $25,000 bond issue to build an auxiliary electric light plant at the lower instake, to cost $16,000. The communication was referred to the city council, meeting to be held subject to the call of the mayor.

SAN FRANCISCO, CAL.—The Light and Power Council, which engineered the late strike against the Pacific Gas & Electric Company, has filed a petition in the State Court of Appeals asking that the city be compelled to show cause why it should not, through the Supervisors, regulate the rates for the sale of illuminating gas.

SEATTLE, WASH.—A resolution has been passed providing for the installation of a system of cluster lights on Fifth avenue, Bell, Battery, Wall, Vine and Cedar streets, with poles, conduits, wires and other appurtenances as may be necessary, according to plans to be pdepared by the city engineer. Cost will be assessed against the property.

LOS ANGELES, CAL.—Notice of sale of franchise sought by Pacific Light & Power Corporation has been withdrawn by board of supervisors because proposed franchise did not provide that in event of consolidation of territory covered by grant with city or town municipality shall have right to purchase. Supervisors postponed action for two weeks.

SAN FRANCISCO, CAL.—For the Portola Festival many thousand special decorative street lighting Mazda lamps will be used, aggregating one million candle-power. This does not include the special lighting installed by other than the Portola committee. The large bell of lamps installed on Market street is 200 ft. high, and 120 ft. in diameter at the lower rim, which is just above the trolley wires. An electric fountain in Union Square is also a feature of the festival.

SALT LAKE CITY, UTAH.—Unless the Supreme Court overrules the decision of Judge Fred C. Loofbourow, the Utah Light & Railway Company will have to pay a meter tax of $1 per year on each meter in service to comply with the ordinance passed by the city council during 1910. The electric company refused to pay the tax on the ground that it was unconstitutional. The city carried the matter to the courts and the decision of Judge Loofbourow last week closed the first round in the legal battle which ensued. It is understood the company will appeal the case to the Supreme Court.

SALT LAKE CITY, UTAH.—At a luncheon given last week by the Utah Light & Railway Company to representatives of the electrical manufacturers, jobbers, contractors and supply dealers, General Manager Joseph S. Wells, Commercial Agent Bayard W. Mendenhall and Auditor Will Browne explained that the company plans to open an electric shop and commercial office in the heart of the shopping district, and outlined that it would be the policy in the future, as it has been in the past, to co-operate fully with all electrical interests, particularly the supply dealer and contractor, who might fear injury to their business if the central station company should adopt a price-cutting policy. Aside from pushing the sale of electric ranges and similar appliances for which the market now is limited, the company proposes to maintain such retail prices as will enable small dealers to do business at a profit, and believes that the additional business created will more than offset any business taken away from the other electric stores.

TELEPHONE AND TELEGRAPH.

PHOENIX, ARIZ.—Plans are being drawn for rebuilding of the Mountain States Telephone Company's system in the valley and for extension of the system in the city.

BLYTHE, CAL.—S. D. Kamran has been granted a franchise for telephone and telegraph system and to maintain same for a period of 50 years over certain streets, public places and highways in Blythe.

SAN DIEGO, CAL.—The San Diego Home Telephone Company has applied to the commission for leave to issue notes in the sum of $150,000 for the purpose of paying existing indebtedness, and for making additions and betterments to its system.

DOWNIEVILLE, CAL.—The Pacific States Telephone & Telegraph Company is erecting a new line from Nevada City to Downieville. The workmen are now at Goodyear's Bar, four miles from here, installing a heavy No. 6 galvanized wire, which will insure connection with the outside world in the winter time.

VANCOUVER, B. C.—That the Canadian Government intends making an early start on the construction of a telegraph line from Clayoquot to Friendly Cove, on the west coast of Vancouver Island, is affirmed in a statement made by J. T. Phelan, superintendent of telegraphs for the Canadian Government at Vancouver. The line will be extended to other points.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company is having plans prepared for a Class A building, to be erected on property on Hill street, between Sixth and Seventh streets, to cost about $130,000. New toll switchboard of larger capacity has been ordered, and will be installed in the new building. This toll board will require an outlay of about $100,000. Owing to the heavy increase in traffic between Los Angeles and San Diego and other cities, it has been arranged to provide two additional circuits be-

tween Los Angeles and San Diego. This with two additional circuits between Corona and Elsinore, and three additional circuits between Riverside and Corona, will involve an expenditure of about $62,000.

TRANSMISSION.

HELENA, MONT.—An application for permission to install and operate another electric power generating plant in Helena has been presented to the city council by the Standard Engineering Company. The petition was signed by A. L. Goldschmidt, secretary of the corporation, and was referred to the committee of street railways and electric lights.

SEATTLE, WASH.—The Washington State Public Service Commission has set November 3 for an open informal hearing in Seattle on the proposed rules and regulations to govern the overhead electrical construction provisions of the law passed by the last legislature. Invitations have been extended to all the electrical companies and electrical workers' unions to be present.

LOS ANGELES, CAL.—The Big Creek development of the Pacific Light & Power Corporation is expected to be in partial operation by January 1, 1914, and will at once add largely to the earning power of the company, in addition to decreasing operating expense. By use of the hydroelectric power the company will be able to close down steam stations, which will be held in reserve, and use the cheaply generated hydroelectric power for distribution in the Los Angeles territory.

WOODLAND, CAL.—To offset a petition being signed at Lakeport and Upper Lake, remonstrating against the granting of the application of the Yolo Water & Power Company to use the waters of Cache Creek for power purposes, by the State Water Commission, another petition is being circulated here. The local petition is directed to the Water Commission of the State, that the prosperity of the people of Yolo County depends in a large measure upon the success of the plans of the Yolo Water & Power Company.

TRANSPORTATION.

VICTORIA, B. C.—A company which is being formed to operate motor busses in this city plans also to build their own vehicles here.

HELENA, MONT.—The campaign for the construction of an interurban electric line out of Helena through the valley has been started. John D. Ryan has agreed to subscribe $50,000 providing Helena raises a like sum. Frank J. Edwards is chairman of the committee.

STOCKTON, CAL.—The Stockton Terminal & Eastern Railway Company has applied to the commission for permission to issue bonds in the sum of $15,000. It desires to pledge $10,000 as security for loans, and proposes with the balance to provide necessary ballasting.

SAN FRANCISCO, CAL.—Judge Murasky holds that the "intersection" is the outer line of the street and not the center of it, and has ruled that the Post street franchise of the United Railroads extends to the outer line of Market street only, and therefore the company cannot run its Post street cars down Market street.

SEATTLE, WASH.—The City Council has passed and Mayor Cotterill signed an ordinance accepting as an unincumbered gift the Lake Burien car line, a trolley road extending from South Park to Lake Burien. It was built by property owners to develop land south of the city. It is proposed to extend the line north to the center of Seattle and south of the Three-tree point, where connection may be made with a ferry to Vashon island.

PORTLAND, ORE.—Considerable interest was centered in the trial run of the Ewbank motor car, which promises a revolution in heavy traction power methods. The electric motive power is generated within the car, distillate being used for fuel. The car equipment is electrically the same as on a trolley car except that the energy is obtained from a dynamo on the front end of the car. The run is said to have been entirely successful.

VALLEJO, CAL.—James Grace of the Northern Electric Railway Company is now engaged in securing right of way preparatory to the construction of the road between Fairfield and this city, the last stretch necessary to complete the line to Sacramento. A branch line which will leave the Fairfield-Vallejo road at Napa Junction and run north to the city of Napa, is also to be built immediately, and it is largely in connection with these rights of way that Grace is now here.

SAN FRANCISCO, CAL.—A. M. Mortenson, traffic manager of the Exposition, has filed his first tariff of the Exposition Terminal Railway with the commission. The charge for switching carload shipments from car barge at the freight slip of this company to any point within the grounds reached by the company's rails will be $10 per carload. This covers the return of the empty car to the car barge. For switching carload or less than carload shipments from one point within the grounds, except from car barge at freight slip, to any other point a charge of $5 per carload will be made.

LOS ANGELES, CAL.—The Commission has ordered that the Pacific Electric Railway Company submit for the approval of this commission a plan for the instructing, training, examining and testing of its employes, and plan of an automatic block signal and staff signal system, covering its entire system outside of city limits, including the location, type and estimates of cost of such signaling system; and a statement showing the location of all crossings of its tracks by roads or highways, what, if any, protection or warning is provided at such crossings; and a further statement showing the location of crossings of main line tracks by other main line tracks, the protection against collisions which now exists at such crossings, together with estimates of the cost of instaling at all such crossings adequate interlocking plants.

WATERWORKS.

SUPERIOR, ARIZ.—According to Mr. Kellner, new water works are being planned for this town. The plans call for bringing water from two lakes located on Queen Creek. Work of piping will begin in the near future.

DALY CITY, CAL.—The clerk opened the bids for the construction of the main line of the water system to be laid along the Mission road, including all connections. The Contra Costa Construction Company was awarded the contract on its bid of $8900.

BAKER CITY, ORE.—Director Frank Gardiner of the Baker Commercial Club reported the cost of the construction of a 12-in. steel pipe line from the reservoir to South Baker to be about $37,500 for the necessary 12,600 ft. of 12-in. steel pipe. He asked the club to endorse a petition on the matter.

RICHMOND, CAL.—The members of the Richmond municipal water district at a recent meeting held in the city council chamber of the city hall, issued instructions to City Attorney Hall to begin preparations for the calling of an election to raise $2,500,000 with which to construct a municipal water system for this city.

SAN FRANCISCO, CAL.—A meeting of the stockholders of the Spring Valley Water Company has been called for Friday, December 19, to vote upon the proposition to increase the bonded debt from $28,000,000 to $30,000,000, the proposed increase to be represented by two-year 5½ per cent notes, payable semi-annually, and secured by pledge of bonds.

SAN FRANCISCO, CAL.—The Spring Valley Water Company has applied to the commission for authority to issue $300,000 of 6 per cent notes, secured by $400,000 of its 4 per cent bonds, for the purpose of paying off mortgages on watershed lands acquired in Alameda County, and indebtedness incurred in the construction of the Calaveras dam.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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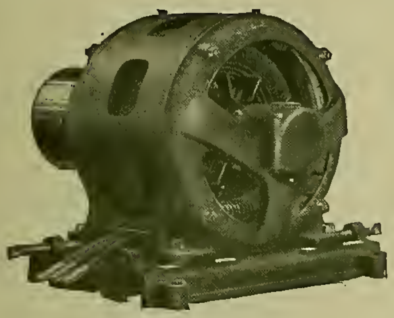

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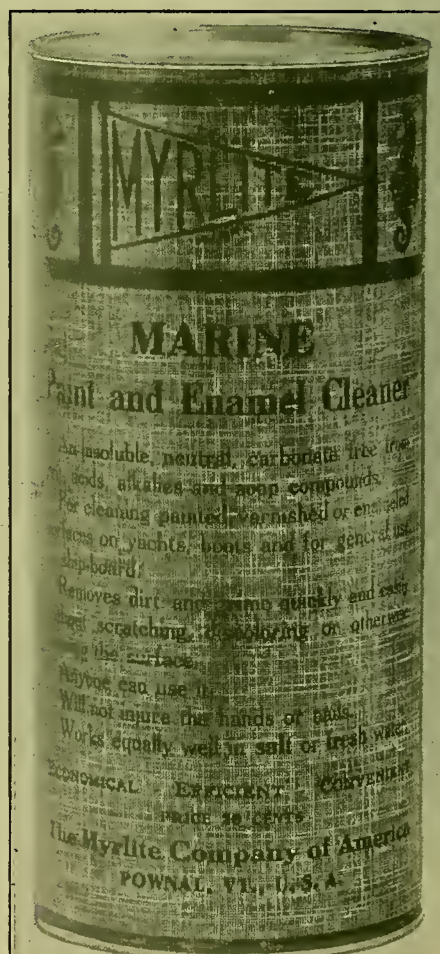

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JOURNAL OF ELECTRICITY
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ELECTRICAL FEATURES—PORTOLA FESTIVAL 1913.

Following the advice of the Electrical Development League to "Do it electrically," ensured the success of the San Francisco 1913 Portola Festival, October 23-26, and the light and color of the spectacular excellently executed and at the same time creating a standard difficult to excel.

The first indication of the part electricity was to play in the festival was the decorating in advance of

Market Street at Third and Kearny—The Mazda Lamp Bell.

electrical effects were largely responsible for the many glad memories left with those who were privileged to enjoy them, while the "spirit of the West," which is at once expressed in pioneering, thoroughness, and things done better, added many new electrical features one of the arc light standards, as shown in the accompanying half-tone. A large open-work gilt basket was built around each standard, and this was filled with long-fronded palm leaves, which, together with the scarlet poinsettia, gave to the decorations a grace

peculiarly Californian. A mass of other foliage and artificial flowers filled the baskets to overflowing, while from a point near the top a number of strings of incandescent lamps were interwoven throughout all. Where these lamps escaped from the foliage altogether and hung clear over the edge of the baskets, a considerateness heretofore unthought of had provided frosted lamps to subdue the glare.


Typical Arc-light Standard

There were fitted up in this way 180 arc light standards, each having,—and it was here that the supreme surprise of the electrical decorations, even to the electrical men, was made apparent,—each having one hundred 25-watt Mazda lamps. With the one exception of the electrical floats, but few carbon filament lamps were used, the high efficiency Mazda lamps almost entirely displacing them. The Sunbeam Lamp Works alone supplied over 26,000 Mazda lamps.

This change could not have taken place in order to save installation expense, for where in previous years four candlepower carbon lamps were used, 25-watt, and sometimes 40-watt, Mazda lamps now took their place. It was an evidence of progress.

At night the regular street arcs appeared decidedly bluish by contrast with the myriad Mazdas, and if you wish to mentally conjure up the appearance of the whole, you must picture nearly 200 giant Roman candles, each with its shower of golden rain falling and with blue balls of fire starting up from all. This lane of perpetual pyrotechnics, arrested in action, was banked on either side by buildings ablaze with light; San Francisco's fine showing of electric signs adding greatly to the brilliant effects of light and color. Wherever buildings had found it necessary to relamp existing sockets, and on new installations, high efficiency lamps were used, except where the Portola colors of Old Spain were responsible for subdued lighting, which meant "dipped" lamps and carbon.

At the end of this lane of light rose the Ferry tower, with its 4,000 eight-candlepower carbon filament lamps, many of which were colored. There were also 150 lamps in the "1915" figures, and toward the bay the electric sign, "Panama-Pacific Exposition; California Invites the World," contributed a thousand more Mazda lamps. The electrical department of the Ferry building deservedly gained the prize awarded for the best illuminated building.

At Third and Market streets was installed the mammoth "bell," although at a distance it looked more like a horn of plenty which emptied into the streets a never-ending stream of revelers. This bell was 18 ft. in diameter at the top, 120 ft in diameter at the bottom, where it barely cleared the trolley wires, and was 200 ft. in height. This brilliant centerpiece of the decorative down-town lighting contained three thousand five hundred 25-watt Mazda lamps. By equipping this bell with a double deck, double drum, high-speed flasher, operated by a 1/15 h.p. motor it was given the appearance of revolving.

The fourteen street intersections north of Market, between and including Kearny street and Grant avenue, to California, Stockton, O'Farrell, Powell and Ellis streets, added 3500 additional 40-watt Mazda lamps, the decoration consisting of a basket, the same in design as that installed on the arc-light standards, suspended above the center of the street, with strings of fancy red-colored paper shaded lamps to each corner building. Other sections, Chinatown and outlying districts all contributed their quota of electrically illuminated buildings.

Union Square, which was the center of festival ceremonies, the vantage point from which to view the daylight fireworks, and also the fireworks park, was decorated by Japanese, the decorations being typical of that race. The hundreds of Japanese lanterns were lighted with carbon lamps, but the canopy of the Sampan, or houseboat, used as a bandstand and for ceremonial purposes, was studded with Mazdas.

The electric fountain, one of the most interesting and attractive features, was built around the Dewey monument in Union Square, and the discussion as to whether or no the tusks of the four walrus should bend upward or down was immaterial to them, for they were for the nonce in their native element. A large basin of galvanized iron was built around the lower part of the pedestal to contain the water, and around the sides were two rows of Federal sign receptacles, in connection with which it is interesting to note that no other precautions were taken to protect them from the falling water than the use of rubber gaskets. A false cornice built around the top of the pedestal concealed other lamps and the pipes containing the jet nozzles.

One 4-in. pipe formed a circle which contained six hundred 3/32-in. nozzles pointing upwards, and a 3-in. pipe fitted square to conform to the pedestal of the monument, allowed water to fall from several hundred holes with which it was pierced. The main pipe was of 6-in. diameter, fed from a centrifugal pump driven by a 40 h.p. 220 volt, d.c. motor. The pump, motor and outside of the basin were hidden with foliage. For the lighting of the fountain 40-watt Mazdas were used, which had been dipped, purple, blue, green, and amber, and an equal number of clear, making 420 lamps all told. These were arranged on a Federal flasher, giving twelve different color schemes per minute, and these were reflected on the water with exceedingly pretty effect. The total number of lamps in Union Square was 1500, not including the fountain.

In the installation of the special electrical lighting ordered by the Portola Festival committee, 55,000

ft. of weatherproof wire from No. 10 to 4-0 120,000 ft. No. 14 weatherproof, 40,000 ft. No. 10 duplex and 20,000 ft. rubber-covered wire, a total length of over 40 miles of insulated wire, were used.

Many buildings were outlined with electric lights, for this system has seemingly lost none of its popularity or attractiveness, notwithstanding the revolution in this class of lighting promised by the advent of the use of projected light at the Panama-Pacific Exposition. Among the many buildings so outlined were the Palace Hotel, Hale Bros., Herbert's Bachelors' Hotel, White House, St. Francis Hotel, I. Magnin & Co., Roos Bros. and the temporary City Hall.

The fleet of warships anchored in the bay contributed their share to the feast of lights as only American warships can, although at times the fog caused a little disappointment to those trying to view this spectacle from the shore. Probably that is why a fleet of ships came on land, although there is a further probability that the committee arranged this as a tribute to the valorous Vasco Nunez de Balboa, who was made Admiral by the King of Spain because of the successful issue to his land expedition which resulted in the discovery of the Pacific, for at this festival Gasper de Portola, who discovered San Francisco Bay in 1769,—also after a land expedition,—was almost eclipsed by the commemoration of the discovery of the Pacific by Balboa in 1513, and it was Portola's festival for awhile, only in name.

The fleet of eighteen ships which came to land were built around flat trolley cars, thus permitting an abundant use of light and making possible a climax to the festival which excelled anything of this kind heretofore seen in San Francisco. Each boat was studded and hung with vari-colored jewels of incandescent lights from stem to stern. The ships represented the Greek Trireme, which had also a very pretty effect of delicately colored lanterns embodied into the design of the craft, and Spanish rather in appearance, a Viking Galley, Chinese Junk, Columbus Ship, the Santa Maria, Sir Thomas Drake's ship and an English man-of-war, 18th century, a Portuguese sailing vessel, Indian Canoe, old fashioned side-wheeler Cristoba, a model of the Savannah, the first steamship to cross the Atlantic in 1842, a stern-wheeler, two American man-of-war vessels, the Constitution (1812) and the Monitor (1860), other warships and then the Queen of Pageantry float. An estimate made of the rated candle-power of the lamps used in the electrical parade was very conservatively placed at 100,000, and the whole electrical effect proved an enchantment which the revelers pronounced the most artistic, interesting and exhilarating ever witnessed in San Francisco.

Ferry Tower.

Don Gaspar de Portola and Vasco Nunez de Balboa represented the Spirit of Discovery, and it is fitting that this most successful celebration of their achievements should have been literally expressed through the greatest discoveries of this electrical age.

CANALIZATION OF THE COLUMBIA AND SNAKE RIVERS.

BY JOHN H. LEWIS, State Engineer, Oregon.

[Writing of proposed and desirable developments in northwestern states, the author, among other matters of interest, directs attention to the practicability of cheap hydroelectric power development, incidental to the interlinking of a system of navigable streams and its great possibilities in the building up of industries. The paper, which is abstracted, was presented at the Convention of the Columbia Snake River Waterway Association, 1913.—The Editor.]

Now that there is prospect for the early completion of a 40 foot channel across the Columbia River bar, it is important that definite plans be made for connecting up the various links in the 200 miles of navigable waters tributary to this outlet. The time appears ripe for a concerted movement for the improvement of navigation facilities for the benefit of every section of the 254,000 square miles of territory tributary to the Columbia River bar.

Any plan of development should take into account the use of water for navigation, irrigation, power development and other purposes. We have an unusual problem, which must be solved in an unusual way. The unusual feature is the enormous quantities of water power which can be developed incidental to navigation. The problem therefore is to find new uses for this unused power.

The development of this vast empire seems to me to be progressing backward in the most discouraging manner to the farmer on whom we are dependent for its final accomplishment. The first step in a program for National irrigation should have been to provide a national system of water or rail transportation for the marketing of products raised on the vast irrigation projects.

What transportation means to the farmer can be expressed briefly by the following figures, which are approximately correct: $1.00 will pay for carrying 1 ton 15 miles on an efficient wagon road, 150 to 300 miles on an efficient railroad, 1500 miles on inland deep waterways, and 2000 to 3000 miles on the ocean. His market radius will be extended by inland waterways five times farther than if dependent on railroads alone, and about ten times farther if accessible to the ocean.

Why is it necessary to await appropriations by Congress when we have an enormous reservoir of credit in the two billion dollars of assessed valuation of these three states? If cities have learned to loan the credit of all the people to furnish economical street pavements, water supplies, and electric light systems, why should not the people of the great Columbia basin loan their credit to provide economical water highways for the speedy and economical development of this region? If the various states could co-operate, each with the other, and with the United States, the problem would be simple.

I believe it safe to say that there is more undeveloped water power within economical transmission distance of the city of Portland, than within a like distance of any other city in the world of its size, similarly situated on tide water. If The Dalles water power project, now under investigation by the state of Oregon, can supply thirteen times the power now used by Portland and the surrounding territory, then it is but natural to enquire as to what uses such enormous quantities of power can be put.

The Cyanamid Company of Niagara Falls is now operating six, three-thousand horsepower electric furnaces in the production of a nitrogen amoniate fertilizer, using current at about $15 per h.p. year. The market for the product is said to be increasing faster than men can be educated to carry on the work.

Enormous quantities of electric power will, in the near future, be used in the manufacture of iron and steel, and in the smelting of copper, zinc, and other ores. Iron and steel can be produced in Portland cheaper than in Pittsburgh according to figures furnished by Mr. Potter, former superintendent of the Illinois Steel Company's plant in South Chicago, if electric power at low cost can be had. A high grade iron ore from China can be landed on the Portland docks for 7 cents per unit of iron, in comparison to 8 cents for Lake Superior ore in Chicago. With power at $9 per h.p. year, electric steel rails could be manufactured at $17.50 per ton, where the regular price is about $40. As electric steel rails have been found to be almost unbreakable in service, they are now commanding a premium of from $6 to $10 per ton over open hearth and bessemer rails, according to the same authority. The capital cost of an electric iron and steel plant is about one-third that for a coal using plant. This fact is of great importance to the west. Ore can be obtained from Mexico, Chili, Cuba, or other points if the Chinese supply should prove unavailable.

Pig iron is now being produced by the electric process in Shasta county, California, at about $14 per ton where the same grade at Pittsburgh costs $17.25 per ton. Charcoal equal to cne-third the weight of the ore used in the electric furnace, must be had for this industry. As about two cords of fir wood is required for one ton of charcoal, a market can thus be had for our waste wood products. Cheap electrical power can also be used to convert this wood into charcoal. For six years such an electric process plant has been in successful operation at Vancouver, B. C., using waste wood from saw mills.

As a result of experiments by the U. S. Bureau of Mines, it is stated that "there is no reason metallurgically why electric heat may not be substituted for the heat derived from the combustion of carbon in the smelting of copper ores. It depends largely upon the relative cost of coke and electric power. Coke and electricity are about on a par when coke costs $7 a ton and electric energy 0.15 cents per kilowatt hour, or about $10 per h.p. year."

Zinc ores are now being shipped from Australia to Norway for smelting in electric furnaces, and in Tasmania a 200,000 horsepower plant is now under construction for the smelting of the complex ores of that region.

The foregoing statements should be sufficient to convince one that there is a very large market for the employment of cheap electrical power in many new industries which are not now in the field. I will next point out briefly the amount of undeveloped water power available on the Columbia River and Snake River to Huntington, and state what I believe to be the necessary steps to secure its development.

At Cascade Locks, 190,000 water horsepower can be developed at low stage of the river by construction of a 10 ft. dam at the head of the rapids, and a canal in Washington less than 1000 ft. in length. The low water head of 24 ft. will thus be increased to 34 ft. Such a dam will greatly improve navigation conditions between Cascade Locks and Big Eddy. The high water head will be only 14 ft. Sufficient water will, however, be available to maintain the required power output. By removing a number of obstructions to navigation in the stream below, the power possibilities at this point would be somewhat improved.

At Big Eddy 536,000 horsepower can be developed for eight months in the year, which plant will deliver 300,000 continuous electrical horsepower, according to a preliminary report made by the state engineer. The cost is estimated at $77 per h.p. and low tension power can be furnished in the vicinity of the plant at $6.90 per h.p. year.

A dam approximately 180 ft. in height completely closing the present river channel, and a canal 1½ miles in Washington will afford a head of 85 ft. at low water and 32 ft. at extreme high water. Owing to difficulties in turbine design, only a range from 42 to 73 ft. of this head will be needed to give the above results. This will afford ample leeway for construction of the Cascade Locks power project and still leave room for some storage above the upper project to carry peak loads.

This proposed dam, at the head of Five Mile Rapids will place Celilo Falls ten feet under water and drown out 6½ miles of the navigation canal now being constructed by the United States around this obstruction. The lower 1½ miles containing three locks can be used in connection with the power project, the boats entering the wide open river immediately above the dam. This project if constructed, will likewise benefit navigation for many miles up stream. The state of Oregon has appropriated $15,000 for a more detailed investigation at this point, and authorized co-operation with the state of Washington, and with the United States.

With the completion of the Celilo Navigation Canal, the Columbia River will be navigable, with more or less difficulty to Priest Rapids, 198 miles above Celilo. The Snake River is now navigable, with some difficulty from the Columbia to its junction with the Grande Ronde River, a distance of 167 miles. These minor obstructions can easily be overcome by low dams, constructed entirely at the expenes of water power projects. President Roosevelt vetoed a water power grant which if developed would have greatly facilitated navigation to Lewiston, because it was throught such grant did not properly safeguard the peoples rights.

In the 27 miles between Lewiston and the mouth of the Grande Ronde River we have a total fall of 110 ft. or 3.8 ft. per mile. From the Grande Ronde River, to Homestead, which point is four miles below the Ox Bow power project, now under construction, is a distance of 96 miles. The Snake River falls 930 ft. in this distance or 9.7 ft. per mile. It flows through a narrow rock walled canyon not more than 400 ft. in width, as shown by the maps of the army engineers which are available as far as Pittsburg landing, 77 miles above Lewiston. In the 59 miles between Home-

stead and Huntington, there is a fall of 250 ft. or 4.2 ft. to the mile. The banks are not so precipitous in this portion of the river.

In the 182 miles between Lewiston and Huntington, there is thus a total fall of 1290 ft. Much of this can no doubt be utilized for power development, incidental to the improvement of the river for navigation. The balanced piston type of lock, or inclined cable way can be used with little loss of time by boats going over the water power dams.

Ten thousand second feet of water will be available at low stage for the first high dam to be erected just above the junction with Grande Ronde River. This for a 200 foot head would develop 227,000 continuous water horsepower. Assuming bedrock to be found 100 ft. below the water surface, or 90 ft. below the bed of the stream, it is not believed that the dam will cost to exceed $40 per electrical horsepower. Estimating $35 for power house and equipment will bring the total cost to $75, which is a very low figure. Industries located at this site could have both rail and water transportation to the markets of the world.

This dam would create a slack water pool over 20 miles in length and afford water transportation to the next dam above. At such site only 6000 sec. ft. of water will be available which is approximately the amount passing Huntington. In this way it is estimated that 800,000 electrical h.p. could ultimately be developed between Lewiston and Huntington. If any use can be found for this power, a construction charge of $100 per h.p. would be most reasonable. It would thus yield eighty million dollars for construction purposes; making the river navigable at no expense to the people. Ignoring this water power value, there is no hope of ever securing navigation for the upper Snake River Valley in Idaho and Oregon.

It is the duty of these two states, in co-operation with the United States to investigate thoroughly the feasibility of this project before conditions become more complicated through the construction of railway grades near the water surface of the stream.

The first and most important step in my opinion, for the Canalization of the Columbia and Snake Rivers is the creation, by Congress, of a National Water Board, having complete jurisdiction over all interstate and other waters under the jurisdiction of the United States, and which are beyond the control of the state water authorities. Such board should have power to protect the public interest and make definite grants on such terms as may be specified by Congress. The revocable permit and indefinite water power tax imposed by the nation and state should be eliminated, unless it is the plan to undertake all such development at public expense. Pending such legislation, the various states should amend their constitutions, so as to utilize the public credit, if necessary, to secure development.

Each state should erect a demonstration power plant and furnish free power for a number of years, during the experimental stage of the various new industries which may be attracted by such conditions. The electric iron and steel industry was established in Norway by such method. As soon as the industries are on a paying basis, the price of power can be equitably adjusted and the information gained during the operation can be used as a basis for the enactment of more enlightened state and national laws relating to water power. If we establish demonstration farms to promote agricultural development, why is it not just as logical to establish demonstration power plants to encourage industrial development.

In 1914, the people of Oregon will vote upon a constitutional amendment authorizing the issuance of bonds equal to two per cent of the assessed valuation of the state, for the purpose of irrigation and water power development, and for developing the cut over timber lands of the state.

The key to rapid development of the great Columbia River basin, lies in a closer co-operation between the various states, and the nation, and the carrying out of comprehensive plans, in logical order, as the time for each step becomes ripe.

LETTER TO THE EDITOR.

Electrical Threshing in Idaho.

[Pioneering is a pleasure, more particularly when others know that we are the ones who did the pioneering, and it is eertainly disappointing to have credit, where there be such, go to another when it rightly belongs to us.

It so often happens "that the makers of better mousetraps," or more important commodities are not known simply because they do not tell it to others, or perhaps, tell it to those who already know, or would readily learn, instead of seeking a wider audience.

The news item published in our October 18 issue, directing attention to the electrical operation, "as far as is known," of the first threshing machines in Idaho is supplemented by the letter received from the Idaho-Oregon Light & Power Company, which we are more than pleased to publish in order that the credit be more nearly located and more accurate information given to our raaders.

The letter which Mr. Orr, the district manager of the company, has been kind enough to forward to us is indeed appreciated, and will, we hope, serve to encourage others to correspond with the editorial department regarding anything published in our columns regarding which they may have a different viewpoint.

Friendly discussion is of greater service to the general public in the dissemination of knowledge than the most profound lecture.

Probably your own outlook and ours may be enlarged by such action, which might certainly prove on some matters of great value to other readers.—The Editor.]

Dear Sir: Beg to advise that I note in your issue of October 18th that you mention that the "first threshing machine operated by electric power in Idaho was installed in Hagerman Valley this season."

First Electrically-Operated Threshing Machine—Idaho.

Wish to advise that I am enclosing a picture of a threshing machine that has been operated by electricity for the past two years on the Florence Bell Land Company's ranch, near Payette. We have two such installations in use near here at the present time. Both are Case threshing machines, operated by Westinghouse motors. Power for these is supplied by the Idaho-Oregon Light & Power Company.

Yours very truly,
IDAHO-OREGON LIGHT & POWER CO.,
By J. F. Orr, District Manager.

ELECTRICAL PUMPING AND IRRIGATION

THE SELECTION AND INSTALLATION OF A SMALL PUMPING PLANT.

BY B. A. ETCHEVERRY.

[Continued.]

Final Selection of Type of Plant.

The final selection of a pumping plant should be based on a careful consideration of the factors stated above. The best size of plant, the period of operation, the kind of engine or driving power, can only be correctly determined by a final consideration of the cost of installation and cost of operation. Where electric power is available, the choice is between a steam engine, a gasoline engine and an electric motor. The electric motor requires minimum attendance. It is reliable and its first cost is much less than that of a gasoline or steam engine. For these reasons if electric power is available, an electric motor is preferable and will prove far more economical even should the cost of electrical energy be higher than the fuel cost for a gasoline or steam engine.

The application of the above information and cost data to any particular case is illustrated by the following examples:

A 20 acre orchard is to be irrigated by pumping from a surface body of water requiring no wells. The quantity to be applied is 6 in. per month, and the total depth in one season, 18 in. The lift is 50 ft. and the discharge pipe 200 ft. long. Engine gasoline or distillate costs 12 cents per gallon. Assuming the pump is operated 1/3 of the time or ten twenty-four-hour days each month, this will require a pump capacity of 225 gallons per minute, which is obtained with a No. 3 centrifugal pump and 7 h.p. engine, as shown in previous tables. The discharge pipe will be 4 in. in wil be about as follows:

First Cost of Plant.

No. 3 centrifugal pump	$ 57
7 h.p. gasoline engine	450
Priming pump, suction pipe, fittings, etc	50
Freight charges and hauling	30
Wood-banded discharge pipe, 200 feet of 4 inch	40
Installation, 5% of cost	35
Building to house plant	40
Total cost	$702

Total Annual Cost of Operation.

Fuel cost of 7 brake h.p. engine for 3 periods of 10 days each or 720 hours (page —) $= 720 \times 7 \times 2.00 = 10{,}000$	$100
Fixed charges at 17% of first cost	120
Attendance 720 hours at 10 cents	72
Total cost for 20 acres	$292
Cost per acre, $15.	

Where electric power is obtainable, the first cost of plant and annual cost of operation for the same conditions, assuming the unit cost of electric power to be 3 cents per kilowatt hour, would be:

First cost of plant	$375
Total cost of operation (annual)	215
Cost of operation per acre	11

Tabulated below are the first costs of gasoline engine pumping plants and the costs of operation for orchards of 20, 40 and 80 acres for lifts of 50 ft., and 150 ft. and for different periods of operation. For the higher lifts single acting triplex pumps are used. The costs given are based on gasoline at 12 cents per gallon, for a depth of irrigation of 18 in. for the lower lift and depths of 18 in. and 12 in. for the higher lift, it being assumed that by careful use of water, if the soil is retentive, 12 in. may be sufficient. The discharge pipe is assumed to be 200 ft. long.

Cost of Pumping with Gasoline Engines and Centrifugal Pumps for 50 Ft. Lift.

Gasoline, 12 Cents per Gallon.

Area in acres.	No. of 24-hour days pump is operated monthly.	Capacity of pump. Gal. per min.	No. of pump.	Horse-power of engine.	First cost of installation.	Annual cost of operating per acre; 18 in. depth of water applied. Fuel.	Fixed charges.	Attendance.	Total.
20	5½	400	4	12	$970	$4.80	$8.25	$1.90	$14.95
	10	225	3	7	700	5.10	6.00	3.60	14.70
	20	113	2	5	590	7.00	5.00	7.20	19.20
40	5	900	6	25	1575	4.50	6.70	.90	12.10
	11	400	4	12	970	4.80	4.10	2.00	10.90
	20	225	3	7	700	5.10	3.00	3.60	11.70
80	10	900	6	25	1575	4.50	3,35	.90	8,85
	22	400	4	12	970	4.80	2.05	2.00	8.85

Cost of Pumping with Gasoline Engines and Single-Acting Triplex Pumps for 150 Ft. Lift.

Area in acres.	No. of 24-hour days pump is operated monthly.	Capacity of pump. Gal. per min.	Horse-power of engine.	First cost of installation.	Annual cost of operation per acre for a depth of irrigation water of: 18 in. Fuel.	Fixed charges.	Attendance.	Total.	12 in. Total.
20	8 1/3	270	15	$1850	$9.90	$15.75	$3.00	$28.65	$24.35
	12 1/2	180	10	1375	9.90	11.70	4.50	26.10	21.30
	25	90	6	1025	10.90	8.70	9.00	28.60	22.00
40	13 1/4	340	18	2200	8.70	9.35	2.40	20.45	16.75
	16 2/3	270	15	1850	9.90	7.90	3.00	20.80	16.50
	25	180	10	1375	9.90	5.85	4.50	20.25	15.45
80	26 1/2	340	18	2200	8.70	4.70	2.40	15.80	12.10

The capacities of pumps, especially plunger pumps, and the sizes of engines vary with the different makes, and for that reason the sizes given are not always obtainable, but sizes approximating these can be used in place.

The above cost estimates are only approximate. They are based on the conditions stated above and are not applicable to all cases because of the varying conditions which make the installation of nearly every pumping plant a special problem. The estimates are made for gasoline engines and are considerably higher than for electric motors. The first example showed that with an electric plant the cost of pumping was only 73 per cent of the cost with a gasoline plant. The tabulated values show the following interesting results:

1st. The cost per acre of pumping is much larger for a small area than for a large area.

2d. The cost per acre does not vary considerably with the period of operation, and in some cases a plant moderately large operating for a shorter period will cost less per acre than a smaller plant operating a longer period. This is due to the lower fuel cost with the larger and more efficient plant and the decreased cost of attendance for the shorter period of operation which overbalance the larger fixed charges. Even should the resulting cost be smaller for the smaller plant, the inconvenience due to pumping for a long period and the extra labor in irrigation may overbalance the saving in cost.

3d. For the lifts assumed a period of operation equal to about ten twenty-four hour days during the

month or one-third of the time during the irrigation season seems to be preferable with the centrifugal pump. With the higher price triplex plunger pumps a period of operation of one-third to two-thirds of the time is preferable.

Co-operative Pumping.

The lower cost per acre for larger areas shows the advantage to be gained by co-operation between small owners. By uniting and installing a large plant instead of several smaller plants, the cost of installation and operation is very much reduced, and the plant can be given more competent attention, which relieves the orchardist and increases the life of the plant. Where by such co-operation several hundred acres can be brought together, a central steam plant to generate electric power, which is transmitted to the several electric motor pumping plants, is the most economical and best solution.

For separate plants above 20 or 40 h.p., gas producer plants connected to gas engines will furnish the cheapest power. These plants are reliable and easily operated. They consist of the producer in which hard coal is placed and through a process of partial combustion, in the presence of air and steam, forms the gas which operates the engine. Gas producers operated on hard or anthracite coal have been in successful operation for a number of years, and those operated on soft or bituminous coal and on oil are coming into use, but are still in the experimental stage. The fuel consumption is very low, usually from 1 to 1½ lb. of coal or 1/6 to 1/7 of a gallon of crude oil per horsepower hour; or ½ to ¾ of a cent per horsepower hour with hard coal at $10 per ton and about 1/3 of a cent with oil at 2 cents per gallon. This is from 2½ to 6 times less than the fuel cost with gasoline at 12 cents a gallon. Producer gas plants are more expensive than gasoline engines and for smaller plants the fuel economy will be overbalanced by the larger interest and depreciation charges. For very large single plants, high duty steam engines will be the most economical form of installation.

Limits of Economical Pumping.

The cases previously worked out for gasoline engine pumping plants show that for small tracts of 20 to 80 acres the cost of lifting sufficient water to give a depth of irrigation water of 18 in. will range for a lift of 50 ft. from about $8.85 per acre for the larger area to about $15 per acre or the smaller area, and for lifts of 150 ft., the respective costs are about $15 and $25 per acre. These costs may seem high as compared with gravity water, but to obtain an idea of the economy and feasibility of developing water by pumping, comparisons must be made with the value of gravity irrigation water in the same conditions. Except in southern California, up to a few years ago gravity water obtainable without pumping has been available. For that reason pumping has not been necessary, and comparatively few pumping plants have been constructed. However, water is becoming more valuable and the steps which many irrigation companies are taking to conserve water and prevent losses of transportation by carrying the water in concrete lined canals and in pipes constructed at considerable expense, show that in some localities at least, water has become sufficiently valuable to justify pumping. If a comparison is made with water thus obtained, we find that the cost of construction of a well constructed system may go up to $50 or $60 per acre and even higher. This cost is charged up to the land which is sold to the orchardist and in addition reasonable profit is made on the value of the land. It is probably conservative to assume that land under an irrigation system in localities well developed and where irrigation is necessary, will cost at least $100 per acre more than similar land for which there is no gravity supply. The chief advantage of gravity systems is the low annual cost of operation, usually less than $2 or $3 per acre, although in some cases it may be as much as $5 per acre or more, but if to this be added the interest on the difference in cost between land under the irrigation system and land which is to be supplied by pumping, assumed at $100, the total annual cost may be $10 to $15 per acre. This is about equal to the cost of pumping with gasoline engines to a height of 50 ft. and about half as large as for lifts of 150 ft. Where electric power is available or for large pumping plants the cost of pumping would compare very favorably with gravity water, even for higher lifts than those stated above.

Some of the advantages of underground pumped water as compared to water obtained from a gravity irrigation system are:

1st. An underground supply is more reliable and is not likely to be deficient before the end of the irrigation season.

2d. The irrigator is independent and controls his own water supply, and is prepared to irrigate his crops at the best time.

3d. The underground water is free from the seeds of weeds.

A consideration of pumping in some of the well developed irrigated districts is of interest to show its feasibility. In eastern Washington water is being pumped in one case to an elevation of 250 ft. above the source of supply. In the citrus district of southern California lifts above 200 ft. are not unusual, and it is considered profitable to pump 460 ft. In the Pomona district of southern California the cost of pumped water averages $15 per acre for one acre foot when purchased from irrigation companies, while for smaller private plants the cost is often greater. In 1905 the Irrigation Investigations Office of the United States Department of Agriculture made tests on various pumping plants and these show that the cost of pumping at private plants of 10 to 100 h.p. with lifts of 100 to 300 ft., varied from $10 to $90 per acre for one acre foot of water.

There is a limit beyond which it is not economically feasible to pump. In the California citrus districts lifts above 400 ft. have been considered profitable. For the orchard lands of the Northwest equally high lifts should be profitable, for the net return per acre from a good apple orchard is usually more than that from a citrus orchard. A citrus orchard 10 years old should average a net profit of $100 to $150 per acre. The net profits from apple orchards 10 to 12 years old in the Yakima Valley are given in bulle-

tins of the United States Department of Agriculture as $200 to $600 per acre. With profits larger than those obtained from citrus orchards in southern California, what has been considered feasible in pumping there, is at least equally so for apple orchards or other valuable crops when no other more economical source of water supply is available. However, for small pumping plants and small areas it is well not to exceed 200 ft., while for larger plants lifts of 400 ft. may be economically feasible.

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Motor Busses in London.—The London General Omnibus Company now has 2500 motor busses in and around London and others are being rapidly built at the company's factory. There are over 30 garages for these cars. A standard motor bus has been designed, as the company assumes that the experimental period has passed. Originally the company bought its busses abroad, but now their own factory can produce all the vehicles that are likely to be required. The modern motor bus is of 35 h.p. and its chief improvement is in quietude of running—indeed, this advantage is being questioned as a danger, because there is so little noise to herald the approach of the machines. The company trains its own drivers, finding the most suitable recruits from men who have driven heavy vehicles. Every motor bus is removed from the streets once every 10 days to be thoroughly overhauled. The company has its own inspectors to watch the drivers and to warn those who may show signs of negligence.

A Chinese street railway in the native city of Shanghai was inaugurated on August 16, 1913. It is two and one-half miles in length and is the first electrical street railway in any Chinese city (as contrasted with foreign settlements). The work was done entirely by Chinese, with Chinese capital.

Fuel oil consumption this year by the United States Navy is estimated at 30 million gallons.

A GAS COMPANY'S PUBLIC POLICY.

BY LESTER A. WRIGHT, Chemist, San Diego Con. Gas & Electric Company.

(Gas companies as public servants are subject to considerable abuse and the author points out that their public policy should be such that the customers realize just what is being done to ensure satisfactory service and so eliminate this as far as possible. Attention is directed to the principles which should stimulate the activities of each department to achieve this end. The paper was presented before the Pacific Coast Gas Association convention, 1913.—The Editor.)

In the not very remote past it was the policy of public service corporations to regard the public in the light that the less they knew the better. The ignorant public, however, was a very suspicious one and suspicion leads often to unfriendliness.

It is a peculiar thing about the people of the United States, men in all walks of life, of all occupations and all degrees of education, all have a warped idea of public officials as soon as they cease being private citizens and chiefly because they do not know the facts and will not trouble themselves to learn them.

It has always puzzled me, (that is ever since my father became a public official) why men who enjoy respect as private citizens, immediately upon election to office become objects of abuse and contempt, and I have wondered how these public officials can withstand the withering fire of these indignities and how they discover the fortitude to proceed with their duties in the face of the accusations of malice and ignorance.

It is with this selfsame public that the gas company has to deal and in the same position as these other public servants. But treating them as has been done in the past only makes matters worse and the managers of the present have awakened to the desirability of friendly relations between their companies and the public. "Public Policy"—there have been loads of articles, advice and preaching on this subject and it would seem that the extraordinary quantity of good counsel must long ago have had its effect, the reforms adopted and an era of peace and good will begun. Unfortunately the new policy has not come about as swiftly as the logic of the situation would bid.

Being a member of one of the Byllesby companies and knowing that these companies stand on terms of exceptional friendliness with the public in the communities they serve, Mr. Bostwick, our secretary, asked me to outline the public policy of the Byllesby organization in this paper. In methods of minor detail and daily practice, it is impracticable to have a uniform method, due to local conditions. There are, however, fundamental principles applying to the conduct of public utilities which have application in any locality. To quote one of the Byllesby officials "Public utilities exist for the purpose of contact with the public. In modern town life they enter into the lives of nearly every individual every day out of the three hundred and sixty-five. Their work is a series of constant contacts with the public."

The public's idea of a gas company has been and still is in many cases, that of an octopus whose tenacles stretch out in every conceivable direction and do nothing but bully aud rob the common people.

Public utilities in reality are the most democratic of commercial institutions. They serve people of all classes in the human scale, with more uniformity in price and quality than any other business. Gas s supplied the negro washwoman, the grocery man's wife, the banker's and the millionaire's wife of the same heating value and at the same price.

A few of the Byllesby maxims are, "Deal fairly with the public in all things relating to the company's activities." "Take every precaution to treat the public in a courteous and respectful manner." "Enter into every activity for community advancement with a will and furnish financial assistance in big public undertakings whenever practicable." "The employe who serves our company best, is the employe who serves the public best."

A man's pride is his vulnerable point, his "Achilles heel" as it were; he can stand poor service, poor pressure, pipes stopped up with naphthaline, etc., to some extent if his pride has not been stepped on. But if it has, he often imagines less than an inch pressure when in reality there is five. A discourteous retort, an impertinent clerk, a tactless collector, will often times make him so angry with a company that all its good service will not appease him. The employes of a gas company are paid to be courteous, they are serving the public. It is the people's money that is paying their salaries. A pleasant and tactful employe is worth more to a gas company than two or three adding machines or their human counterpart.

Some time or another a company is going to come before the council or the public, asking for franchises or maybe fighting for its very life, in which case it is far better to have a friend in the public than a suspicious and doubtin one, as facts, figures and logic are seldom of avail against the inflamed mind of the public.

A gas company cannot be too careful of the mental caliber of its employes and their consideration for the public especially when things are rushing and the employe is in a nervous, hurried state of mind. The saying "A soft answer turneth away wrath" is a very true one and many a friend is made for a company or turned into a perpetual enemy by the answer given to him when he comes in, angry to kick about too high a bill or something of the kind. The Byllesby people have made it plain that they do not expect their employes to assume a grovelling attitude nor to appear to scrape favor at the expense of self respect, as there is neither necessity nor occasion for seeking the influence of individuals by fawning and flattery.

I am going to run through the various departments of a gas company under the Byllesby regime trying to show their principles:

The Manager.—The manager of a company, its highest official, is all important in the matter of friendly public relations; he is called upon in regard to many matters outside of company business, concerning the welfare of the community. He mixes with the leaders of thought and action, he belongs to the business clubs, the country clubs and must mingle in the best society. His personality stands in a large measure for the personality of the company. He must conduct his office the same as a public official, have his door always open to whoever thinks he must see him and big or little, give him his undivided attenton. Like any public servant, senator or assemblyman, he has a varied constituency and the more he comes in personal contact with it, the better able he is to obtain its confidence and a sympathetic point of view. A broad acquaintance is of great value to him and a good memory for faces and names is a gift to be cultivated with great care.

The Superintendent.—The superintendent, while keeping in touch with operation, construction and technical matters, is often called upon to take the manager's place in his absence and the same qualifications are necessary for a man in his office, a good mixer as well as a technical man.

The Complaint Department.—The Byllesby organization includes a complaint department which handles all disputes and complaints. A separate room is provided with pressure gauges, jet photometers, glass enclosed meters, etc., with a competent man in charge. The man in charge of this department, must not be hasty in his conclusions; to deal successfully with the people who come to his office with grievances, seemingly irreconcilable, he must have a good insight into human nature.

Look in the dictionary and find the definitions of complaint; some of them are:

"An expression of grief."
"A finding fault."
"A disease."

With a few people, the making of complaints has developed into a disease. But in the majority of cases, the consumer really thinks or knows something is wrong and is not making complaint simply for the purpose of finding fault, hence the importance of having a complaint man who is diplomatic enough to look at the complaint from the consumers' standpoint and apply the remedy or explanation needed.

The same complaint from the same location a great many times hay lead the complaint man to believe the complainant has the chronic disease of complaining. But as a rule this is not the case. Some real reason exists; the fault lies with the trouble men. Now the complaint must be remedied eventually, why not on the first visit? In San Diego the trouble man is supposed to put on the tag attached to the meter, the trouble, date and his initials. After three visits the meter is brought in.

Every employe of a company should be a trouble man and every official should make it his duty in case of trouble near him, to get there and give the remedying of it his personal supervision. The fact that an official of the company is there no matter whether he knows if the trouble be poor gas or a stoppage, appeals to the complainant's pride so that he feels the company is doing all in its power. There is nothing, gentlemen, like a little attention from an official to remedy troubles; a consumer may only have gas of 450 B.t.u. still if an official of the company gives him a good reason for the trouble and explains that everything that can be done will be done to remedy the matter, tells him that he will see to it personally, the gas almost immediately looks better to the consumer. The thing to do is to be honest with the public and they will appreciate it and in times of emergency, help you out by taking the necessary poor service in good part.

Collection Department.—The collectors, meter readers and trouble men come in contact with the consumers continuously and a little pains on their part will make many friends for the company. If when the trouble man blows out the service pipe he will ask the housewife if there is any other service he can render, such as adjusting her stove, etc., she will appreciate it and regard the company in a more friendly light.

The Accounting Department.—A crowded office always causes a considerable amount of confusion and confusion causes overworked and nervous clerks, short answers and disgruntled customers. It is the policy of the Byllesby organization to provide large offices and plenty of clerks to equalize the work by regulating the meter readings so that bills come due on different days in the month and thus save confusion. This relieves the strain upon the office force which usually falls on it around the first of the month and promotes more accurate work.

The Advertising Department.—A greater part of the public sees the company's advertisement every day than comes to the office or speaks to an employe once a month, and this advertising is accepted as expressing the spirit of the organization to a considerable extent. Therefore it behooves a company to take great pains with its advertising, not to advertise too much nor too etensively, as consumers will say that you are buying such and such a paper with your advertising or that the money you put in advertising had much better be put in giving better service, etc. Still there can be a certain tone in the advertising given out indicative of the company's policy, how it regards its customers, etc.

The New Business Department.—The new business department is in constant touch with the public. They (the salesmen) are out after business and through their dealings with the public are in a better position to know what the people are thinking about, what they want in the way of service and how they look at matters relating to the company, than any other department. It should therefore co-

operate with the other departments to keep them posted as to public feeling. A few salesmen do not take the trouble to stand up for the operating department, to appreciate that it has its troubles as well as the others, nor do they stop in their effort to make a sale to satisfy some customer concerning an apt to be imaginary complaint. But a great many do and in lots of instances the new business men have been extremely valuable in overcoming prejudice and hostility.

Rates.—Now as to rates, the Byllesby people charge the manager of their property as much for gas as any citizen, every employee must have a meter and pay the same as his next door neighbor. I heard my father one winter remark to my mother, when she was indignant over the largeness of her gas bill, that Mrs. So and So, the manager's wife, was complaining about her large bills too, which immediately made my mother feel better satisfied.

As I have said before, entering into muncipal improvements, with both vocal and financial support, helps win for a company the confidence of the public. In San Diego this last summer it was found that the town had grown beyond the expectations of the city water department and that the big supply main was not big enough to keep all parts of the city in water, the warm weather coming on. They couldn't buy pipe and get it on the ground inside of a month or so. The gas company stepped in and not only loaned the city pipe which it had already laid out for a main extension of its own, but loaned the city its employes to help lay it, thus gaining the good will of the city officials and praise from the people.

Until a gas company operates on this hypothesis, that every customer may take his business away from the company if he chooses, they will not get the support of the public. It is immaterial to a gas company how ordinary mercantile institutions treat their customers. They themselves, because they operate monopolies, must treat their customers better than competitive business institutions and must make the public aware of that fact to gain the public confidence and fulfill to the fullest extent the purpose of their life.

No one doubts the beneficent results that eventually followed the great civil war of the United States. No one doubts the loss of life and money and no one, at least of the preceding generation, forgets the pain and anguish and bitterness of that struggle. The public service corporations in the past have made no greater errors of judgment or management, nor have they made greater departures from the correct rules of conduct than have the individuals, communities and governments with whom they have dealings. And so with the assistance and good will of the public, the utility companies of the present will do all in their power to serve the people faithfully and well. The more honest a corporation is with the public, the better success it will have in the long run. To quote a few lines in closing: "Life is a matter of mutual exchange. The man who gives nothing, gets nothing; the attempt to get something for nothing is equally futile in business, in society and in friendship; legitimate trade is merely a matter of exchange for mutual benefit.

It is this giving and taking—this recognition of our mutual need—that has held the world together, and the one who fails to understand this fundamental human relation has missed the meaning of life."

The Isthmian Canal Commission statement of classified expenditures shows that $2,928,208.83 was expended by the department of construction and engineering during the month of June, 1913. For the six months ending June 30, 1913, this department expended $17,777,602. The total expenditures of the commission to that date being $298,985,812.90.

CENSUS REPORT ON ELECTRICAL MACHINERY.

Statistics of the electrical machinery, apparatus, and supplies industry in the United States for 1909 are presented in detail in a bulletin soon to be issued by Director Harris of the Bureau of the Census, Department of Commerce. It was prepared under the supervision of W. M. Steuart, Chief Statistician for Manufactures.

This industry includes the manufacture of the machines and appliances used in the generation, transmission and utilization of electric energy, together with most of the parts, accessories and supplies for them. It does not include, however, the production of poles, whether of wood, iron or steel; nor does it include the manufacture of glass and porcelain ware made expressly for electrical purposes, that of bare iron and copper wire, or any of the group of electrochemical and electrometallurgical products.

The total number of establishments in the United States in 1909 engaged in the manufacture of electrical machinery, apparatus and supplies was 1009. The total number of persons engaged in the industry was 105,600, of whom 102,950 were wage-earners. The total capital employed was $267,844,432, and the total value of products was $221,308,563.

The industry in 1909 was largely centralized in the six states of New York, Pennsylvania, New Jersey, Massachusetts, Illinois and Ohio. These states, together, reported 83.9 per cent of the total average number of wage earners, 82.6 per cent of the total value of products, and 83.1 per cent of the total value added by manufacture.

New York was the leading state in the industry, ranking first at the censuses of 1909 and 1904. During 1909 this state produced electrical machinery, apparatus and supplies to the value of $49,289,815, or more than one-fifth of the total for the United States. The number of wage-earners employed in the state increased 83 per cent during the decade ending with 1909, while the value of products and the value added by manufacture more than doubled.

Pennsylvania ranked second among the states in 1909 and 1904 in value of products and in value added by manufacture, though in the average number of wage-earners employed it dropped from second place in 1904 to fourth place in 1909. In 1909 New Jersey, which showed the most rapid development of any of the six leading states in the industry, ranked third in number of wage earners employed and value of products, advancing from fourth place in number of wage-earners and from fifth place in value of products during the preceding five years. Michigan, which occupies a position of minor importance among the states in the industry, shows the largest percentages of increase in all three items, while Connecticut, Indiana and Wisconsin also show large relative gains.

Establishments owned by corporations constituted more than two-thirds of the total number of estabments reported, and the value of their products represented 96.3 per cent of the total value in 1909 and 95 per cent in 1904. In 1909, 1692 wage-earners, or 1.9 per cent of the total, were employed in establishments under individual ownership; 1167, or 1.3 per cent, in

those under firm ownership; and 84,397, or 96.7 per cent, in those owned by corporations.

Of the 1009 establishments reported for 1909, 31 manufactured products valued $1,000,000 or over. In 1904 there were 22 establishments of this class out of a total of 784. While such establishments represented but a comparatively small proportion of the total number at both censuses, they reported 57.1 per cent of the total value of products in 1909, and 60.5 per cent in 1904. The average value of products per establishment increased from $179,604 in 1904 to $219,335 in 1909, and the average value added by manufacture, from $94,353 to $111,737. The average number of wage-earners per establishment increased from 77 in 1904 to 86 in 1909.

Value of Products.

In 1909 there were 16,791 dynamos of all kinds manufactured of a total value of $13,081,048. Of these, 13,882 were of direct current, and 2909 of alternating current. During the decade ending with 1909 there was an increase of 59.5 per cent in the number and of 143.2 per cent in the total capacity, of dynamos produced. The average capacity per machine increased from 55 kw. in 1899 to 84 kw. in 1909.

There were 76,729 transformers manufactured of a total value of $8,801,019.

The production of switchboards in 1909 was valued at $5,971,804.

Some 504,030 motors of a total of 2,733,418 h.p. and a value of $32,087,482 were manufactured in 1909.

The number, capacity, and value of motors for transforming electric current into mechanical power were very much larger in 1909 than in 1899. The number of motors of all kinds produced increased 215.5 per cent during the decade, their capacity 123.8 per cent, and their value, 64.5 per cent. The largest increases are shown in the case of the motors for operating stationary machinery. The general report on manufactures shows a large increase in the use of electric power. In 1909 there were 388,854 electric motors with a capacity of 4,817,140 h.p. installed in manufacturing establishments. In 1899 there were only 16,891 motors reported with a capacity of 492,936 h.p.

The number of primary batteries manufactured in 1909 was 34,333,531 valued at $5,312,595; an increase in value of 498.7 per cent since 1899. The production of batteries was valued at $4,243,984 for 1909, an increase of 65.8 per cent during the decade.

The value of arc lamps manufactured in 1909 was $1,706,959, and the number 123,985. From 1899 to 1909 there was a decrease of 34,202, or 21.6 per cent in the number of arc lamps manufactured and a decrease of $120,812 or 6.6 per cent in their total value. The decrease is accounted for by the fact that, while formerly arc lamps were used almost exclusively for street lighting and other purposes, the incandescent lamps have now replaced them to an appreciable extent.

The production of incandescent lamps showed a valuation of $15,714,809 for 1909 and a total number of 66,776,997. About one-fifth of this total production was tungsten, the remainder being classified as carbon filament.

The value of insulated wire and cables manufactured in 1909, 1904 and 1899 constituted the largest single item in the total value of electrical machinery, apparatus, and supplies reported, representing more than one-fifth of the total value of products for the industry at each census. Of the $51,624,737 reported as the total value of insulated wire and cables, $40,250,572 was reported by establishments in the industry proper, and $11,374,165 by establishments engaged primarily in other industries. Only a small number of the establishments in the industry proper drew the wire which they insulated, while of the establishments outside the industry reporting this product the greater number were engaged primarily in wire drawing. New Jersey, Illinois and New York were the three states leading in this branch of the industry in 1909, reporting 63.8 per cent of the total value in that year and 66.1 per cent 1904.

PANAMA-PACIFIC EXPOSITION ELECTRICAL DISTRIBUTION SYSTEM.

The capacity of the conductors is sufficient to provide for dark days when ground lighting would be needed before the closing down of the motor load. On this account the exposition peak has been taken as follows:

Luminous arcs	500 kw.
Exhibit palaces, buildings, etc.	5,000 kw.
Foreign nations, states and U. S. Government	2,500 kw.
Concessions	2,500 kw.
Direct current motors	1,000 kw.
Peak load	11,500 kw.

Except for an overhead system in rear of the concessions district, and another in the extreme western part of the grounds in the vicinity of the race track, the distribution system will be underground.

The overhead systems are of the standard pole line construction. The underground system is based upon the use of wood fibre duct and manholes of wood construction. The box or trough construction will extend between manholes and will vary in size to suit the number of ducts to be provided. The space between the duct and the wood trough is to be filled with sand, except at the entrance of the manholes, where four lineal feet of concrete will be used. This particular type of underground conduit was adopted because of its mechanical strength and economy. The short life of the exposition required an economical design throughout. The average cost of installation is, approximately 10 cents per duct ft. with the wood manholes of the shallow type averaging $25 each and the deep section type averaging $50. No subway type transformers will be used, as all transformers will be placed in the main exhibit palaces. Vaults for the transformers will be required in a number of the states' and foreign nations' buildings.

All electric energy will be distributed throughout the grounds at a primary voltage of 4000 a.c., with secondary voltages as stated in a previous issue. All energy will be purchased by the exposition company from one of the local power companies, which will construct a central station on the exposition grounds. Present indications are that while the exposition voltage is 4000, the generating voltage will probably be 11,000 stepped down to the exposition primary voltage. In the event of this special station being disabled in any way, power will be drawn from other sources of the power company.

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POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
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Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Illuminating Engineering Society

There seems to be no end to the number of engineering societies to which one might belong and where at one time it was a pleasure to boast membership in practically all of them, the individual now closely analyses the derivable benefits before signing the membership blank. In the final analysis, membership in some societies is indispensable, while in others, the benefits to each member are difficult to trace.

In all it is true, too, that mere membership will not benefit. It is possible to benefit only by active participation in the work of each society or at least by perhaps selfishly using the knowledge which the research of each society establishes.

It might be pointed out that membership in a Botanical Society could be made to contribute towards increased business for the manufacturers of say Iluminating Glassware, or Reflectors, if the proceedings of the society were carefully followed. "Certain illuminants used in greenhouses are injurious to the plants," and at once the manufacturer commences to develop this market with a special line of reflectors for electric lighting of greenhouses, and a new outlet has been found for electrical goods, bringing business, as is usual, to every other branch of the industry as well.

Although the derivable benefits are not quite so far-fetched, it often seems possible to get along without certain memberships, but there are others which so contribute to the advancement of the industry as a whole, that membership just happens as a matter of course.

In this latter class is the Illuminating Engineering Society which, strange to say, has had no representaton, other than that of individual membership, in the whole of the territory west of Chicago.

On the Pacific Coast, a Section of the Illuminating Engineering Society would be at once profitable and desirable. Original research work and important and unique installations are of frequent occurrence here and it is imperative that these be given the greatest publicity, first from the view-point of pride of performance, second in that they are novel and embody many excellent features of importance to the industry, and third, that a knowledge of what has been accomplished and what has proven, for the time being, best, will, if properly disseminated, improve standards and so increase business. Presented before a section meeting and thoroughly discussed, the subjects become at once clarified and invested with authority.

This society was organized in 1906 and although no special membership campaigns have been conducted it now has about 1500 active members. It is a society, in the business of which, Consulting Engineers, Architects, Central Station Employees, Salesmen and in fact every branch of the industry and the allied professions may profitably participate.

The transactions of the society are issued nine times each year and total approximately 6000 pages; a considerable amount of space being devoted to the reports of original research work and the practical application of the principles involved.

Its activities make for higher standards, new ways and methods—the more excellent way—and bigger

business. It breathes in the spirit of co-operation. It is worthy your support if only for the reasons that it aims to educate the layman also as to what constitutes the best in illumination equipment and is thus responsible for increased business combined with greater satisfaction in the use of our product. The field is still however largely uncultivated as witness the many inefficient installations which transgress the first principles even, of what constitutes the best in illumination.

One annual convention and an annual meeting are held also six or eight meetings in each section city throughout the year. At the present time there are five sections located respectively in Boston, Chicago, New York, Philadelphia and Pittsburg.

The reason for the non-existence of a Pacific Coast Section may be due to the conservatism of the society. At no time has it been the policy to actively solicit membership but a measure of publicity is certainly essential in order that a "local" section be inaugurated at an early date.

Membership in the Illuminating Engineering Society plus active interest will ensure to all participants a wider knowledge and greater profits. The Journal would like to hear from all those interested in the formation of a Section.

Get Busy

An admission of slack times is often self-condemnatory. "Why is it," wrote Thoreau, "that men give so poor an account of their day if they have not been slumbering. If they had not been overcome with drowsiness, they would have performed something." It is that "something attempted, something done," which occasionally opens up the flood-gates of business prosperity.

We accept the circumstance as conclusive evidence that the condition is. But your news that it rained yesterday is not sufficient evidence that it will rain today, and similarly, that a certain period during each of a number of past years has been a "slack" season is not conclusive proof that the same season this year will also call for complaint. (Whatever good that would do.) Waiting until times are better before you hustle after business is to confess that you have heretofore been one of those who sold, not in the market place, but waited expecting that with so much business, the skies must shower customers upon you. In other words, you may have unwittingly developed the habit due perhaps to too great a "success" in the past, of waiting for the business to come to you instead of getting out even half-way, to capture it and bring it into camp.

There is greater than circumstances, the power that can and will change them.

That power is action. To sit repining—to complain—is to admit the superficial evidence of hearsay or appearance. Actually a form of mental laziness. Throughout the rush seasons there are always certain jobs which we promise to do when we are not quite so busy; there are certain new outlets for our trade which we intend to develop, certain new methods which we purpose trying out. Always, "when we are not quite so busy." Then when the so-called slack season does come, unless the individual prove an exception, all those things are neglected because "times are hard," "money tight" and "no one will do anything anyway."

But why not try, why not get action. That season in which your competitors lie down is the one during which your sales force should be most active, and despite appearances, the season during which you should do those things which have beeen left undone, develop new prospects and try out those new systems. At least try!

A single individual has often developed business sufficient to turn a slack season in the electrical business into a busy one, with the attendant increased activity for other occupations. Circumstances are man-made, and man can change them.

Let us in future not admit defeat before we try, but rather roused from our circumstance induced sleep, let us overcome that drowsiness which is mental laziness, and so give a good and profitable account of each day. So shall we perform something and prosperity come to us, for we shall be awake to the fact that in action is a power which will prove greater than any adverse circumstance we can experience.

The Question of Billboards

Some questions are perennial and one of these is of importance to the electrical industry in that a satisfactory reply implies, by analogy, the existence of another and excellent outlet for goods electrical. "What shall we do with the bill-board," is the ever recurring question to which we refer, and the reply is, "Do it electrically."

Yesterday, or perhaps it was the day before yesterday, incessant agitation against the painted and sometimes unsightly signs then projecting over the sidewalk, found a response in something done better—the electric sign—which with further improvements produced the wonderfully artistic, mechanically marvellous and brilliant creations which today add to the attractiveness and gaiety of cities and return to those responsible for their erection, such splendid dividends,

There are bill-boards and bill-boards. Some in place and some out of place, some good, some bad; others we might improve and again some that we would not even if we could. We are all familiar too, with those signs which are undesirable blots on the landscape. Such misplaced bill-boards, as do those crude, unsightly, or inartistic, excite unfavorable agitation and no one would regret their enforced removal. But on the other hand, properly encouraged and with permanency assured, bill-boards may be made attractive by day and even at this time comparatively brilliant and cheery by night.

The wonderful improvements in the electric sign point to the remarkable possibilities of the electrically illuminated bill-board if those responsible for them are encouraged in their efforts, instead of being discouraged by adverse criticism and legislation.

Restrictive ordinances are sometimes desirable but if they place a premium upon invention and progress and are so made destructive, then public opinion through the effort of some individual or association will revolt and the resultant forced concessions may hinder progress.

You can't make a country home out of a city residence, so why not work for bill-boards electrical which are better?

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Wm. Bromley, state electrician, Ukiah, was a recent visitor at San Francisco.

J. O. Presbey, salesman Holophane Works of G. E. Company, is at San Francisco.

G. C. Harris, president Home Telephone Company, Tulare, Cal., is at San Francisco.

F. M. Cooley, Tungstolier specialist, Western Electric Company, is on a visit to Seattle.

Garnett Young, manager Telephone Electric Equipment Company, has left on a trip East.

M. C. Osborn, contract agent, Washington Water Power Company, was at Seattle recently on business.

C. V. Schneider, Electrical Supply Company, Sacramento, was at San Francisco on a business trip last week.

H. F. Berg, of the firm of Metz & Berg, electrical contractors, Marysville, was at San Francisco on business during the past week.

R. W. Van Norden, consulting engineer, has returned to San Francisco from an inspection trip throughout Tulare county, California.

G. Douglas Jones, electrical engineer for the State Department of Engineering at Sacramento, Cal., was at San Francisco this week.

R. J. Sheets, Link River Electric Company, is at San Francisco on business in connection with the new Court House at Klamath Falls.

C. F. Gilchrist of the meter department, San Joaquin Light & Power Company, Fresno, was among the recent arrivals in San Francisco.

Geo. S. Pearce, city electrician, Sacramento, was at San Francisco last week in connection with the new series street lighting installation for that city.

J. H. Newland, purchasing agent of the San Joaquin Light & Power Company, recently dropped into San Francisco to see the sights of the Portola season.

W. Frank Carr, manager railway department, Parrott & Company, San Francisco, attended the convention of the American Electric Railway Association.

L. H. Baldwin, sales engineer, Kellogg Switchboard & Supply Company, has been transferred to Los Angeles to succeed **C. F. Hartung**, who has resigned.

A. G. Wishon, general manager, and **L. M. Pierce**, general superintendent of the San Joaquin Light & Power Company, Fresno, Cal., were recent visitors in San Francisco.

H. L. Bleeker, vice-president, Washington Water Power Company and president of the Northwest Light & Power Association, was at Seattle on business during the past week.

J. T. Stewart, formerly with the Holophane Works of General Electric Company, has accepted a position with the electrical department, Dunham, Carrigan & Hayden, San Francisco.

H. E. Linden, of the firm of Linden & Parcher, engineers and architects, Bishop, Cal., was at San Francisco in connection with the Mono Lake power hearing before the State Water Commission.

Frank Leonard, formerly refrigerating engineer with Swift & Company, and now associated with the Union Construction Company, Portland, Ore., spent the first part of last week in San Francisco.

W. W. S. Butler, former president of the Western States Gas & Electric Company, has returned to San Francisco, after an extended trip East, during which he spent considerable time at his old home in Virginia.

W. D'A. Ryan, illuminating engineer of the Panama-Pacific International Exposition, was a recent arrival in San Francisco from the East, where he has been for some time past in connection with exposition matters.

S. B. Anderson, district manager of the Pacific States Electric Company, San Francisco, left the latter part of the week on a business and vacation trip which will embrace the Pacific northwest and southern California.

A. H. Babcock, electrical engineer with the Southern Pacific Railroad, presented a paper on "Mountain Railway Electrification" at the meeting of the San Francisco Section of the American Institute of Electrical Engineers on October 31.

R. G. McDonald, engineer Mono Valley Improvement Company, Mono Lake, was at San Francisco to give expert testimony before the commission regarding a case in which certain irrigation, power and city water supply projects are involved.

O. B. Coldwell, general superintendent light and power department, Portland Railway, Light & Power Company, made an inspection trip over the company's system and was accompanied by **C. E. Condit**, **B. C. Condit**, **Mr. Merwin**, and **Mr. Walsh** of the Northwestern Electric Company.

W. N. Matthews, twelfth reigning Jupiter of the Jovian Order, has made the following appointments for the Pacific Coast: **Arthur E. Rowe**, sales manager Telephone & Electric Equipment Company, Statesman for San Francisco; **J. I. Colwell**, Western Electric Company, Seattle, Statesman for Western Washington.

O. P. McCord has been appointed to the sales force of the Westinghouse Electric & Manufacturing Company, San Francisco. He will represent the supply division devoting his time to city business. Mr. McCord is a graduate of the University of Atlanta and also of the training school of the Westinghouse company at Pittsburgh.

OBITUARY.

Joe Lazarus, who died recently at San Francisco, had but a short time since commenced in business as a manufacturers' agent. He was a member of the Sons of Jove.

MEETING NOTICES.

Portland Electrical Contractors' Association.

There was a good attendance at the regular meeting of the association held at the Portland Commercial Club on Wednesday evening, October 23d, at 6:30 o'clock, at which many matters of great importance to the welfare of the members were discussed.

Los Angeles Jovian Club.

Wm. Van Den Heuvel, consulting engineer, formerly with the U. S. Reclamation Service, gave an interesting talk at the Jovian Club lunch on Wednesday last, on the "Disposition of Aqueduct Power." His remarks constituted a "middle of the road" discussion of the power situation in Los Angeles. His conclusions, however, strongly favored the co-operative method of disposing of aqueduct power, using the existing distribution systems under some equitable arrangement with the power companies.

Alameda County Electrical Development League.

At the last regular meeting Mr. W. W. Briggs of the Great Western Power Company gave an informal talk to the members of the Electrical Development League of Alameda County last Saturday, at its regular monthly meeting. The subject of Mr. Briggs' talk was certain lines of co-operation between jobbers, dealers, contractors and other electrical fraternities, with particular reference to the central station situation. Needless to say, Mr. Briggs' talk was heartily appreciated by the members, about forty being present.

Utah Society of Engineers.

At the October meeting of the Utah Society of Engineers, Mr. M. Cheever, chief engineer of the Utah Power and Light

Company, described the extensive construction operations now in progress by his company, which include a double steel tower transmission line 135 miles long carrying two circuits of 5/8 inch copper wire from Grace, Idaho, to Salt Lake City. This line will transmit 100,000 kilowatts of electrical energy with a loss of but three per cent. The present transmission voltage from Grace is 44,000 volts. The voltage will be raised to 130,000 volts next spring, when the line is completed.

Portland Stationary Engineers.

Portland's stationary engineers, celebrating the twenty-first anniversary of the founding of the national association, entertained fellow craftsmen from Salem and Baker Wednesday night with a banquet at the Commercial Club. About 70 persons attended, though all were not engineers of the "stationary" type.

W. I. Barley, chief engineer of the Portland Railway, Light & Power Company, is vice-president of the local association and acted as toastmaster. Brief addresses were made by nearly everyone present, with "Education" as the general topic. Reports were made by Oregon's delegates to the international convention that recently was held in the east.

Oregon Society of Engineers.

Resolutions indorsing the appropriation for the University of Oregon have been adopted by the Oregon Society of Engineers, which represents more than 300 civil, mechanical, electrical and hydraulic engineers, in all parts of the state of Oregon. The organization also is on record favoring the maintenance of both the Oregon Agricultural College and the University of Oregon independent of one another. The association will take an active part in the campaign in support of the university appropriation during the next few weeks. The matter was first taken up by the engineers when the first intimations that a referendum might be filed against the State University were afloat and the institution was formally indorsed by an excursion of the engineers to Eugene last May.

San Francisco Electrical Development and Jovian League.

One of the most interesting and best attended meetings was held at the regular luncheon last Tuesday when the League first heard a very complete report from Mr. A. H. Halloran who represented California Jovians at the New York Jovian Convention, and later listened to an excellent address on "Scientific Salesmanship," by Mr. George H. Eberhard, general chairman Educational Committee and vice-president National Sales Managers' Association of America. The speaker first proved his point that there is a science of salesmanship and then briefly outlined the law of the sale; the necessity for securing attention, interest, desire and action were each presented in their logical order and all present were interested in the speakers' pertinent pointers regarding the proper closing of the sale.

The meeting next week will be under the guidance of the Jovians.

Los Angeles A. I. E. E.

Ernst M. Schmelz of Detroit presented a very interesting paper on the "Manufacture of Steel by Electricity" before the Los Angeles Section of the American Institute of Electrical Engineers. Mr. Schmelz described fully the construction of the Stassano electric furnace, one of which he has placed in service at Redondo. This is a three-phase proposition at 110 volts, and shows decided economies over other methods of steel manufacture. Other electrical features of the Stassano furnace are as follows: The load, amounting to about 1400 amp. per phase, is practically perfectly balanced on all phases. The electrodes are of carbon and of four in. diameter. The furnace uses about 900 kw.-hr. per charge. The cost of the steel product is $27.08 per ton, when operating continuously twenty-four hours each day. This cost is increased to $32.05, when operated for fifteen hours per day. This is on account of the necessity for keeping the furnace hot, as the magnesite brick, with which the furnace is lined, crack if permitted to cool.

TRADE NOTES.

The Pacific Underground Construction Company has the contract for installing ornamental electroliers at Hermosa Beach, Cal.

W. H. Smith Electrical Engineering Company has obtained the electrical contract for the four-story bank building located at Fourteenth and Burnside, Portland. The owners of the building are Mrs. Robert Tiegan and C. Van Fridagh.

Mathias Klein & Sons, Chicago, have recently occupied their new factory at Avondale. There is approximately 37,000 sq. ft. of floor space in the new factory which is up to date in every particular.

Among recent orders secured by the General Electric Company for turbo-generators is that of the Atchison, Topeka & Santa Fe for 2-300 kw., 3600 r.p.m., A. T. B. 480 volt condensing Curtis turbine generator sets with direct connected exciter, for use in their Richmond, Cal., shops.

The Holabird Reynolds Company of San Francisco has been awarded the contract to supply 33,000 ft. of metal moulding for the electrical equipment of the Napa insane asylum at Napa, Cal.; H. W. Johns-Manville Company were awarded the contract for 10,000 ft. of fibre conduit on the same job, while the Benjamin Electric Manufacturing Company will supply the lighting fixtures.

NEW CATALOGUES.

Catalogue No. 55 issued by the Holophane Works of the General Electric Company, lists their celebrated lines of Clearcut illuminating glassware, cut and etched.

Salesmen's portfolios of half-tones for use of the trade are being distributed by the Holophane Works of the General Electric Company, illustrating their line of portable lamps and semi-indirect bowls.

The Wagner Electric Manufacturing Company of St. Louis, Mo., has just issued a new bulletin, No. 103, describing their new single-phase converter. The bulletin deals with the construction and the operating characteristics of the machine and is profusely illustrated with engravings of the machine and its applications.

Bulletin No. A4137 by the General Electric Company, illustrates and describes that company's Curtis Steam Turbines of 100 to 2500 kw. capacity, for driving 60 cycle generators at 3600 r.p.m. These generating sets are of the horizontal shaft rigid frame type, and either two or four impulse wheels are used, depending upon the capacity of the generator. They embody all the latest developments in turbine construction. The bulletin is profusely illustrated, showing details of turbine construction, path of steam flow, and a number of typical installations.

The General Electric Company has issued Bulletin No. A4142, which deals with the various operating conditions which affect the efficiency and life of incandescent lamps. The subject is prefixed by an explanation of definitions, so that the context may be better understood. The advantages to the central station of maintaining high efficiency in the operation of incandescent lamps are analyzed, and curves showing the effects of variations in candlepower, wattage, and voltage, are included in this section. The value of high efficiency to the customer is alone treated and the effect of auxiliary apparatus on the lighting system is shown diagramatically and by analysis. The bulletin is well illustrated and will enable the reader to obtain a knowledge of all the conditions affecting the efficiency of incandescent lamps, and should be of considerable value to the illuminating engineer, central station, sales agent, and the consumer.

THE STATE OF CALIFORNIA WORKMEN'S COMPENSATION ACT.

BY J. R. MOLONY.

[Continued.]

I think you must have been in business long enough to realize that when you buy cheap supplies for use in your own work that you usually secure an article equal in value to the price paid, and there is no reason to apply any other theory to the purchasing of insurance and that applies to private companies selling below cost just so certainly as it will apply to this State Institution.

It is a regrettable fact that it takes little money, no experience and little ability, other than the ability to sell stock, to start an insurance institution and it is also a regrettable fact that many institutions of this kind are being and have been started in large numbers and you will realize that the sole business getting qualification of such an institution is low rates. I wish to say at this time in this connection, that such insurance under this Boynton Act is going to be a much more serious matter than insurance in irresponsible institutions has been heretofore. This must be realized when consideration is given to the enormous responsibilities imposed upon the employers under the schedule of compensation benefits and particularly the fact that life pensions must be paid running over a period of many years, which makes it imperative that an institution furnishing insurance be here to fulfill that obligation twenty-five years subsequent to the date of their contracts. It probably will be said by the representatives of such institutions, whether state or private, that the solvency of their companies is guaranteed by the reserve requirements of various states but the answer to that argument is apparent when you think for a moment that this reserve requirement has been in existence for many years past and in no one instance has it ever failed to permit the bankruptcy of any insolvent institution. There is little likelihood of these reserves being any more adequate in the future than in the past, providing a company is mismanaged. There is no question but that legal reserves now and for years to come, will be entirely too low. All one needs to determine this fact for himself is to glance at the published figures of costs in Germany relating to industrial accidents, which show that on all classes of business this cost has increased anywhere from 200 to 4000 per cent in the last thirty years. In my opinion it is preposterous to presume that competition will allow the charging of adequate rates for this insurance for years to come and unless this is done, legal reserves will not save improperly managed companies and it will only be those companies with the good judgment to properly rate and select their business and to maintain additional reserves beyond those required by law which will live to tell the tale.

I did not come here to solicit your business nor had I any intention of going into this phase of the question at this time in detail, but I do not believe in fairness to you that this subject should be discussed without this matter being called to your attention. If any of the gentlemen present care to investigate this subject further, you can do so by taking it up with representatives of any responsible insurance companies, or if you desire, I will be very glad to give you references to the experiences abroad so you may look the matter up for yourselves. These figures are matters of public record, have been published by the United States Department of Labor and are available in most all public libraries to anybody who is inclined to investigate and has the time to do so. If you have a committee appointed to discuss this subject, it cannot, in fairness to you or to itself, fail to investigate this phase of the business before any recommendation is made to your body with reference to the acceptance of a proposition from any company and that includes my own as well as others.

The safety provisions of this act present an exceedingly complicated subject and should be considered by themselves when more time can be devoted to the subject but in passing I will say that they require all places of employment to be made safe and place the responsibility for seeing that this is done on the shoulders of the Industrial Accident Department, through its superintendent. It provides also, that a representative of this department may determine the standards of safety for places of employment in this State and it is not required that these standards be uniform for the same plants in the same industry. This whole scheme was bitterly opposed by representatives of the Employers' Association on the ground that it placed unreasonable and dangerous powers in the hands of a board which could exaggerate those powers arbitrarily to the injury of individual employers at any time they might see fit. Notwithstanding this objection, the bill was passed with no material change and these powers are now vested in this board and it is highly essential that you inform yourselves in detail as to the requirements of the safety part of this act, otherwise you will be continually faced with the possibility of criminal prosecution for violation of it. To show you how serious this is, I will cite you only one section, No. 66, page 34, of the printed copies furnished by the Industrial Accident Board, which reads as follows:

"Every order of this commission, general or special, its rules and regulations, findings and decisions, made and entered under the safety provisions of this act shall be admissible as evidence in any prosecution for the violation of any of the said provisions and shall, in every such prosecution, be conclusively presumed to be reasonable and lawful and to fix a reasonable and proper standard and requirement of safety, unless, prior to the institution of the prosecution for such violation or violations, proceedings for a rehearing thereon or a review thereof shall have been instituted as provided in sections eighty-one to eighty-five, inclusive, of this act and not then finally determined."

Time will not permit any further discussion of this part of the Act but I would urge as forcibly as possible that you familiarize yourselves with this part of this Act if you desire to escape serious trouble later on.

The questions which naturally present themselves to your body for solution at this time are, first,—whether you desire for the balance of this year to file your election to become subject to the compensation portion of the Roseberry Law or to remain subject to Section 1 of it or that common law responsibility under it. I would suggest that in consideration of this you take it up with your insurance representatives, whoever they may be. They will be able to give you the costs under both parts of the act and furnish you any information which you may desire. You will have to decide what course you wish to pursue subsequent to January 1, 1914, the date upon which the Boynton Act becomes effective. You have open to you in the choice of your insurance carrier, the privilege of doing business with stock companies; becoming members of mutual institutions; purchasing insurance from the State Insurance Fund or carrying your own insurance. These are big questions and would consume considerable time to discuss. The two things, of course, which would be paramount in reaching your decision will be the cost of insurance and the solvency of your carriers. I have already taken all the time I feel I can on the question of solvency and on the state fund. The question of mutuals is one which you should give considerable thought before you accept membership in mutuals, imposing obligations which cannot lightly or quickly be disposed of and with unlimited liability for catastrophe hazards, which undoubtedly will be entirely inadequate to furnish you the protection needed unless the members of those small mutuals which may come into existence here, are willing to face the possibility of losses far beyond any cost to which they could ever be subjected by stock companies. When you think for a moment that mutuals operating here undoubtedly will limit their operations to California under this act, you will realize that they have no opportunity to

spread a catastrophe loss over the large number of risks possible where the insurance is carried by stock companies operating generally throughout the United States. Everyone knows that the theory of insurance fails absolutely when its application is to a limited number of risks in a limited area and I cannot see how small local mutuals can ever fill the needs of employers under such an act as this. The acceptance of a membership in such an institution is accompanied by grave responsibilities when you couple it with the payment of life pensions in unlimited numbers, which cannot possibly be anticipated by such an institution. While it is true that these mutuals will be forced to operate under the same reserve requirements as the stock companies, I wish again to point out the fact that legal reserves never have stopped insolvency and probably never will, although no institution can successfully administer this law without immense reserves, which no small organization can accumulate.

In this connection there is only one other thought I desire to suggest and that is that having determined the financial responsibility of your insurance carrier you have only then placed yourselves in a position to intelligently discriminate between policies offered you by different insuring companies. That is to say, an insurance company might be solvent beyond a question of a doubt and yet fail absolutely to offer you the protection which you ought to have. I believe I have suggested enough varying thoughts in connection with this Act so that you will appreciate the fact that a small company even though solvent, but without an organization sufficient to contend with the difficulties which must naturally arise in the administration of this Act, will be entirely unable to properly protect your interests and hold down the cost of insurance. If its corps of adjusters is not sufficiently large to cover the State and to permit of immediate, proper and complete investigation of accidents, the loss cost must mount up to a figure which will ultimately be reflected in your insurance rates. Coupled with this it is going to be absolutely imperative that the medical organization handling your cases be complete and experienced otherwise it will be absolutely impossible to determine the degree of disability upon any reasonable basis. You must appreciate that waste in any of these processes will be reflected in your individual loss experience, which will necessitate, undoubtedly, a higher cost to you individually than that to which employers in your class as a whole will be subjected if the merit rating system is adopted, as this idea is now coming into vogue throughout the country and is adopted by the state fund and will undoubtedly be adopted before many years throughout the State of California by all insurance carriers. This system requires that rates for all plants be made in accord with the experience on that plant and the physical condition of it. It is designed to rate such risks as present a high loss exposure either through improper management or low physical standard of safety, higher than the average and to rate such risks as present a low hazard, below the average. You must therefore readily appreciate that the day will come when companies which are, through lack of organization, improperly equipped to care for losses, will be instrumental in increasing your future rates. I believe you will, as business men, all agree with me that it costs money to maintain a proper organization, which should include in addition to their claims and medical organization, an inspection department and an audit department, if the rights of all parties concerned are to be protected. Granting this, you must also concede that those companies which do not maintain such departments as they should be, can, at the outset, offer you lower rates than companies which do. The question for you to determine in choosing your insurance carrier is, whether you want low rates today with a certainty of high rates in the future or whether you desire at this time a carrier which will offer you insurance at a fair rate which should remain as near stable as good business judgment and good underwriting sense will permit.

BOOK REVIEWS.

Technical Gas and Fuel Analysis. By Alfred H. White, 255 pp.; 5½x9 in.; cloth bound. Published by McGraw-Hill Book Company and for sale by Technical Book Shop, San Francisco. Price 2.

Technical Gas and Fuel Analysis is a volume of the International Chemical Series, H. P. Talbot, Ph.D., consulting editor. The author aims to present the conclusions of several national committees covering the testing of raw fuel and its manner of utilization and where there has been marked dissent from them..

Electrical and Magnetic Calculations. By A. A. Atkinson, M. S.; 310 pp.; 5x7½ in.; cloth bound. Published by D. Van Nostrand Company and for sale by Technical Book Shop, Rialto Bldg., San Francisco. Price $1.50.

Written for electrical engineers and artisans, teachers, students, and all interested in the theory and application of electricity and magnetism. This book has reached its fourth edition. It is an invaluable aid to acquiring a sound working knowledge of the underlying principles of the subjects, and is also a handy reference, covering the methods of applying the rules and formulae to practical engineering problems.

Farm Gas Engines. By C. F. Hirshfield, M. M. E., and T. C. Ulbricht, M. M. E.; 230 pp.; 5x8 in.; cloth bound. Published by Jno. Wiley & Sons, Inc., and for sale by Technical Book Shop, San Francisco. Price $1.50.

This publication is intended to serve as a guide to those contemplating the purchase of farm gas engines. The theory of the operation of such engines is discussed only to the extent necessary to enable the reader to appreciate what must be found in a reliable engine. So as to assist the prospective purchaser in deciding just what engines available best meets his needs, a chapter is devoted to prices and to those things which affect prices.

Single Phase Commutator Motors. By F. Creedy, A. C. G. I.; 109 pp.; 5½x9 in; cloth bound; published by D. Van Nostrand Company and for sale by Technical Book Shop, Rialto Bldg., San Francisco. Price $2.

This volume will be of value to those professionally interested in single-phase commutator motors and to the advanced technical student and teacher. A clear understanding of the phenomena of the operation of single-phase commutator motors is a necessary preliminary to improvements in practical application. The writer develops in this work simpler methods of studying the general theory of these machines than has been in use, so that it will be intelligible to any earnest reader.

Public Utilities, Their Cost and Depreciation. By Hammond V. Hayes, Ph. D., 262 pp.; 5x8½ in.; cloth bound. Published by D. Van Nostrand Company, and for sale by Technical Book Shop, San Francisco. Price $2.

The object of the work is to bring to the minds of those whose duty it is to ascertain values, first, that it is the duty of the appraiser, not to ascertain the fair present value, which function belongs to the courts or commission, but to ascertain with accuracy such figures as are necessary evidences of value and loss of value; second, that the original cost of a plant may be obtained without inordinate difficulty, and is a figure of importance to those who must rule as to what the fair present should be; and third, that depreciation is affected only indirectly by inefficiency and that, as a necessary consequence, depreciation is dependent solely upon the relation of the age to the life of the perishable property. It is the author's endeavor to present a fair method of arriving at a proper valuation on this basis.

The easy style of the author, together with excellent typography and paper, make comfortable reading. A study of the book is strongly recommended those interested in this subject.

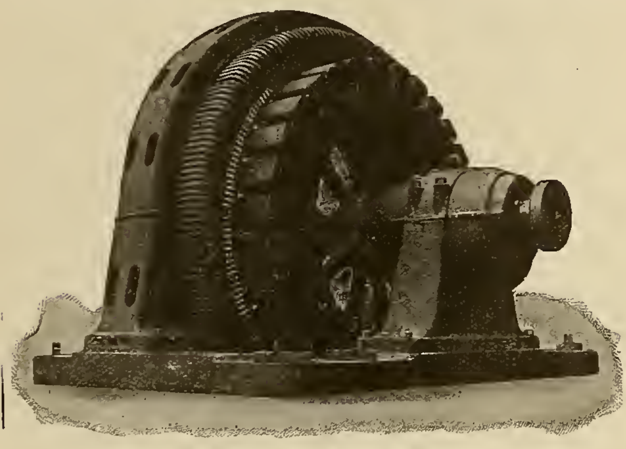
INDUSTRIAL

WESTINGHOUSE WATERWHEEL GENERATORS.

Waterwheel generators have recently been built to conform with the rapid development of hydraulic power for driving electric generators. The increased demands for such service require almost infinite combinations of capacity and speed range. Refinement in the design of both generators and waterwheels have made these changes possible; the successful operation of many high voltage transmission lines and the ever increasing demand for power, all aid materially in the utilization of many water powers heretofore considered either impracticable or inaccessible.

Two types of waterwheel generators are built—horizontal and vertical—depending upon the local conditions in each case.

Waterwheel generators of almost any practical capacity or speed for installation in the smallest isolated plant or the largest hydro-electric generating station have been furnished by the Westinghouse Electric and Manufacturing Company.



Horizontal Generator, Showing Method of Sliding Stator to One Side.

Horizontal Type.—The standard horizontal unit is of the two-bearing, coupled type construction; that is, the generator includes shaft, two-bearings, and a bedplate usually designed to allow for sliding the stator to one side in case ready access to either the stationary or rotating winding is desired.

The stationary frame is made of a strong, rigid iron casting, into which soft steel laminations are dovetailed and securely fastened.

Ventilating ducts are spaced at frequent intervals across the face of the armature punchings, allowing for perfect ventilation to all parts of the active material.

Form wound, interchangeable armature coils fit into parallel open slots punched in these laminations, and these coils are held firmly in place by means of fibre wedges. The coils are insulated and impregnated with fabrics and compounds of high insulating qualities.

No single type of construction will meet the varied requirements in rotor design, therefore, several well tested methods are employed. When comparatively low peripheral speeds are encountered a cast-iron spider with bolted-on, or dove-tailed poles, is usually employed. For higher speeds cast steel, or steel plate construction may be used. In the case of very large relatively high-speed machines, the difficulty of securing perfect castings may lead to the well-proven laminated rim structure.

All field poles are made of thin steel laminations riveted together with overhanging pole tips provided to support the field windings.

Field coils are wound of heavy copper strap on edge, insulated in such a way that each individual turn is exposed to the ventilating air, and thus perfect radiation results. The coil is securely fastened between the rotating spider and the tips of the field poles by heavy coil supports.

All parts are carefully inspected during each step in the process of manufacture, and before the succeeding operation is started. When completed the machine is carefully tested under conditions, as nearly identical as possible, to those which its future service will demand.

Vertical Type.—Westinghouse standard practice recommends that the generator be fitted with two guide bearings which are supported by brackets fastened to the stator frame. Also, a bedplate or pad on which the stationary part rests.

The roller, or thrust bearing, which supports the weight of the revolving part may be mounted on top of the generator frame between generator and turbine, or underneath the turbine. In case it is mounted on top of the generator frame, this frame must of course be made heavier and more expensive, than in cases where it has only to support the stator punchings, winding and guide bearings. Wherever placed this bearing usually supports not only the rotor of the generator, but also the turbine runner, and in addition takes care of any unbalanced water thrust.

A rigid cast iron frame into which soft steel laminations are securely dove-tailed, forms the basis of the stator.

The coils are vacuum dried and impregnated before the outside insulation is applied. This outside insulation consists of wrappings of paper and mica on the straight portions of the coils which lie in the slots, and servings of treated cloth over the V-shaped coil ends. After the outside insulation is applied the coils are treated with an insulating varnish which render them moisture and oil-proof. An insulating cell is provided in each armature slot to prevent abrasion of the coil and a fibre wedge holds coils and cell firmly in position.

In case of failure of a waterwheel governor to act, the rotating part of both waterwheel and generator are subjected to unusual stresses, due to the overspeeding of these parts. The rotors are designed for the maximum obtainable speeds which result in such instances. These overspeeds vary from 50 to 100 per cent. Due to the wide range of speeds encountered, no one type of rotor construction will give ideal results.

There are several designs of rotors, each one particularly well adapted for the requirements for which it is used. Comparatively low peripheral speeds may permit the use of a cast-iron spider with either bolted-on or dove-tailed poles. A higher speed generator may demand an entirely different construction. For such work cast-steel or rolled steel plates are often employed. In case of very large machines, it may be difficult to obtain perfect castings, and here the well-proven laminated rim may be employed.

SINGLE UNIT CAR FIXTURE.

A new single unit fixture has been developed by the Benjamin Electric Manufacturing Company, for street car and steam railway coach lighting which is neat in appearance and overcomes those difficulties which in the past prevented the proper installation of reflectors for this purpose. There are no projecting screws and the glassware is held in position by a cam arrangement which is finally locked so that the vibration of the cam cannot possibly jar it loose. This unit is No. 2377 and is designed for regular car lighting and to fully meet the severe conditions found in this service. It is an addition to the line of car lighting fixtures put on the market by this company and has the added advantage of the Benjamin lamp grip and a separable porcelain socket.

NEWS NOTES

INCORPORATIONS.

TAFT, CAL.—The incorporation is reported of the Domestic Water Company at $10,000, by T. W. Speed, W. C. Thiele and Marguerite Holmes.

SANTA BARBARA, CAL.—The American Gas Company has been incorporated with a capital of $75,000 by W. R. Rowland, T. W. Okey and W. V. Lockwood.

SANTA MONICA, CAL.—The Santa Monica Land & Water Company has been incorporated and the full amount of $1,000,000, subscribed by R. C. Gillis and J. J. Davis.

BAKERSFIELD, CAL.—The General Water Company has been formed with $50,000 capital; shares are $100 each; the incorporators being W. J. McLean, C. R. Stevens, Virgil Shaw, et al.

FULLERTON, CAL.—Articles have been filed by the El Camino Water Company, with Fullerton as the principal place of business. The company is a pumping plant proposition. Capital stock is $10,000. Incorporators are W. A. Goodwin, A. V. Vail, G. A. Gray, A. L. Porter and H. G. Meiser.

FINANCIAL.

LOS ANGELES, CAL.—The proposition made by the finance committee of the city council to the Pacific Electric Railway Company, that they accept payment in bonds for the work on the municipal railway on San Pedro street, has been approved by the railway company, which will immediately purchase $250,000 harbor bonds. This will make the amount set aside for the railway project available for harbor development.

LOS ANGELES, CAL.—The aqueduct power bonds will probably be voted on about November 18th. The Municipal League and the Chamber of Commerce have requested that the issue be segregated into two parts: $1,250,000 for the power development, and $6,250,000 for a distribution system. The majority of the city council, however, is in favor of but one issue, and is endeavoring to have the proposition submitted on that basis.

ILLUMINATION.

POCATELLO, IDAHO.—A cluster light system is being installed on West Center street and the system will soon be extended to other streets.

SAN FRANCISCO, CAL.—At the Land Show just closed, no less than 6000 Sunbeam Mazda lamps were used, ranging in size from 40 watt to 500 watt.

BAKER, CITY, ORE.—The contract has been awarded to the Capital Electric Company of Salt Lake for the furnishing of equipment for the municipal light plant with the exception of the water wheel which will be furnished by J. D. Sutter.

NAPA, CAL.—The railroad commission has granted authority to the Napa Valley Electric to purchase the property of the Calistoga Electric Company and to issue $20,500 of bonds, $15,300 of stock and $5000 of notes to pay for the property.

LONG BEACH, CAL.—K. T. Bennett has been awarded the contract at $11,434 for the installation of part of the ornamental lighting system, and the Woodhill & Hulse Electric Company were awarded a contract at $23,525 for similar work on Broadway, between Alamitos avenue and Water street.

LOS ANGELES, CAL.—The investigation and public hearing held in Los Angeles to secure data for fixing the wholesale rate for gas at the city limits, closed last Saturday. Commissioners Gordon and Thelen, assisted by a corps of experts, held their sessions in the council chamber at the city hall. The commissioners expect to make public their decision within thirty days. The Los Angeles Board of Public Utilities will then immediately announce the rate to be charged Los Angeles consumers for the mixture of natural and artificial gas.

BAKERSFIELD, CAL.—The California Natural Gas Company is arranging to run a 6 in. line to the county seat for the most part paralleling the present 4 in. main to the city limits. The line is to be 30 miles long. The contract for its laying has been let to the Virginia Pipe Line Contracting Company.

VANCOUVER, B. C.—The British Columbia Electric Railway Company has reduced its lighting rates in the Point Grey, Burnaby, Richmond, Delta, Surrey, Langley, Matsqui, Sumas, Chilliwack, Port Moody and other municipalities served by them on the mainland, to conform with the rates charged in the city of Vancouver.

NEWPORT BEACH, CAL.—The State Railroad Commission has granted to the Pacific Light & Power Corporation a certificate of public convenience, permitting them to furnish light and power to Newport Beach. A local company is now operating in this field, but it has been shown that their service and rates are such as to warrant competition.

KLAMATH FALLS, ORE.—Initial steps have been taken by the Klamath Falls City Council toward the construction of a municipal power plant on Link River that will furnish electric power for lights and all other purposes. That the U. S. Government is willing to enter into negotiations with the city for the sale of either water or electrical power was the statement made to the city administration, and acting on this, the council directed City Attorney J. C. Ruetenic to draw up a resolution that will start negotiations between the government and the city.

VICTORIA, B. C.—Street lighting in Victoria has undergone a very considerable change during the past year, and now consists either of magnetite arc or ornamental post lighting. The latter system has found considerable favor, and there are about 2000 standards in the down-town district. The style adopted is a cast iron 5-light standard spaced 80 ft., and the method of location 4 at street intersections, and the remainder opposite. The lamp used is 8 volt, 50 watt tungsten, with 12 in. C. R. I. globes. The lamps all burn until midnight, and alternate posts all night. The installation is paid for by the property owners and the current is supplied by the company and paid for by the city on a kw.-hr basis.

TRANSMISSION.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has closed a contract for furnishing to the Tacoma Dredging Company, on the Lake Washington canal, current amounting to 1200 h.p. This will be used in removing about 1,500,000 yards of dirt.

VICTORIA, B. C.—While Victoria is regarded as a residential city, the power business is one of no inconsiderable size, and extends from the smallest motor to several installations, which take from 2000 to 5000 h.p. each, the largest being in cement plants, having a load factor of approximately 85 per cent.

TACOMA, WASH.—An ordinance has been passed providing for the construction of an auxiliary electric transmission line for the Nisqually power plant from the substation at South Twenty-fifth and C streets in the city of Tacoma to the existing double line in Sec. 15, Twp. 17 N., R. 8, and to appropriate $12,000 for the work.

OGDEN, UTAH.—Joseph A. West, engineer for the Ogden Rapid Transit Company, started a corps of engineers in the field last week to complete the survey of the proposed electric line from Ogden to Logan. This move on the part of the Ogden Rapid Transit Company indicates that they contemplate extending their present interurban line from Brigham City to Logan.

SPOKANE, WASH.—Reclamation of 1,000,000 acres of land in eastern Washington, an expenditure of between $12,-000,000 and $25,000,000 in development of one of the largest irrigation and power projects in the Northwest and opening up of the Priest Rapids country is expected to begin at once. Involved in the project is the electrification of the Chicago, Milwaukee & St. Paul Railway from Cascades to its Puget Sound terminal, the taking over of the Hanford irrigation project on the opposite side of the Columbia River and the merging and constructing of many electric railway lines, according to information said to have been gleaned from a member of the party, which headed by W. J. Close, of Close Bros., financiers of London, is visiting the scene of the project.

SAN FRANCISCO, CAL.—The hearing of the protest of Mono county farmers against the present granting of power rights on Rush and Lee Vining Creeks, in Mono county, to E. G. Ryan, occurred before the State Water Conservation Commission. The city of Los Angeles intervened in the suit and was represented by Attorney S. R. Robinson. The other litigants were the Mono Valley Improvement Company and the Rush Creek Mutual Ditch Company, represented by Attorney A. H. Swallow of Bishop. Those protesting contend that the carrying out of the Ryan water project would divert water from 90,000 acres of agricultural land and render it practically valueless.

QUINCY, CAL.—Notices of location of the waters of Indian, Red Clover and Last Chance Creeks for the purpose of mining, milling, irrigation, and the development of hydroelectric energy, were filed in the office of the county recorder last week. The locators are W. P. Frick of Alameda and the estate of H. E. Pickett, deceased, of Sacramento. The locations include those made by E. D. Bannister several years ago in the same section. The Indian Creek location is of 23 cu. ft. of water per second, which when landed at the power plant site will have a fall of 617 ft. and will produce 1700 theoretical h.p. of hydroelectric energy. The storage reservoir will have a capacity of 368,335,000 cu. ft. The Red Clover Creek unit will land 140 cu. ft. of water per second, with a fall of 1200 ft. at the power plant, producing 19,000 h.p. The Red Clover reservoir will store 864,000,000 cu. ft. of water and will have an area of 1322 acres. The Last Chance unit will deliver 100 cu. ft. of water per second, producing 13,600 h.p. of electrical energy, with a fall of 1200 ft. Its storage reservoir will contain 285 acres, and will have a capacity of 225,284,000 cu. ft. The total cost of the electric power development is estimated to be $1,860,475.

OGDEN, UTAH.—The accidental closing of a switch controlling the mechanism of a motor operated gate valve last Sunday afternoon completely flooded the Pioneer plant of the Utah Light and Railway Company, located about two miles from Ogden on the Ogden River. A man-hole cover on the turbine case had been removed to permit inspection of the turbine, and although there were two operators and several installers in the plant at the time the accident occurred, the rush of waters into the building was so rapid that the men were helpless, and were fortunate in escaping from the building with their lives. The accident to the plant interrupted service on the entire system. The rush of waters continued until the four miles of 6 ft. pipe had drained. By the time they had subsided the interior equipment and part of the walls of the building were a complete wreck. This unusual accident occurred just at the time that extensive alterations to this plant, which have been in progress during the past summer, were practically completed and the company were planning to put it back into service, preparing to handle the winter load. The Pioneer plant was one of the earliest hydroelectric plants to begin operation in Utah, as it was completed in 1896 at a cost of $1,500,000. The electric equipment and turbines installed at that time were so inefficient as compared with present day machinery that the company had discarded them and installed new equipment, which would have increased the capacity of the plant about 90 per cent. The full extent of the damage cannot be determined until the power house can be cleared out and an inspection made of the equipment.

TRANSPORTATION.

SEATTLE, WASH.—A. L. Kempster, general superintendent of the company, announces that the work of installing electric heaters on its long route cars will be done with all possible speed.

LOS ANGELES, CAL.—The city of Glendale has raised a bonus of $40,000 providing for an extension of the Pacific Electric Railway in that city. The new branch will leave the main line near San Fernando Road, Tropico, and will run north on Glendale avenue and will connect again with existing line at Casa Verdugo, thus creating a loop.

RIVERSIDE, CAL.—The railroad commission has refused permission for the Pacific Electric crossing over the Salt Lake on Magnolia avenue, Riverside. The commission has ruled that the street and electric railway tracks must be lowered, the cost to be borne equally by the Pacific Electric, the Salt Lake and the City of Riverside.

SAN FRANCISCO, CAL.—The supervisors' public utilities committee has declared in favor of building a branch of the Geary street municipal line along Masonic street, from Geary to Turk to connect with the baseball park proposed by J. Cal. Ewing, who told the committee that he would conclude the lease arrangement as soon as the recommendation was passed by the board.

STOCKTON, CAL.—At the last meeting of the city council an application made by the Stockton Terminal & Eastern Railway Company for permission to abandon portions of its franchise in this city was granted. Later a franchise for a single track will be sought along Miner avenue to connect the Miner avenue and Union street tracks. The company will not attempt to use its franchise along the bed of Miner Channel from Union to American.

SAN FRANCISCO, CAL.—There will be several kinds of intramural transportation for carrying visitors to any part of the grounds of the Panama-Pacific International Exposition. In addition to motor busses which will take a passenger to any point for ten cents, there will be a double track miniature railroad, which will give a four-mile ride for ten cents; electric jinrikshas, push chairs and bicycle chairs, the charges for which will be moderate.

RENO, NEV.—That an electric railroad connecting the town of Wellington, in Lyon county, and Reno is contemplated by Eastern capitalists is the assertion of men in a position to know. It is said to be the plan of those backing the movement to connect the road with Copper Belt line at Wellington and run the line through Carson Valley, touching Minden, Gardnerville and other towns in that vicinity, to Carson City. From Carson City the line will be carried direct to Reno. The distance is about 75 miles, and it is said that there is ample capital back of the project to put it through successfully. The power to operate the cars is to be furnished by the Truckee River General Electric Company and it is planned to carry freight and passengers, operating on a regular schedule.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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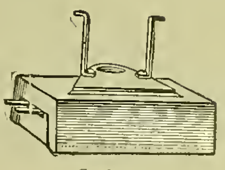

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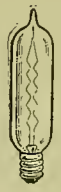

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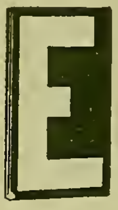

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Journal of Electricity
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

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POWER CONDITIONS IN THE PACIFIC NORTHWEST

BY W. E. HERRING.

(The author directs attention to the fact that since 1910 all operating companies in the Pacific Northwest find they have a surplus of power with no immediate market, nothwithstanding the low charges made. The necessity for securing industries to utilize this surplus power is emphasized. Although millions of water horsepower is being wasted, development cannot occur until this is done. Incidentally, interesting facts describing what is necessary in plant construction and the difficulties encountered both then and during operation add greatly to the value of this article.—The Editor.)

Much has been written regarding the millions of undeveloped horsepower on the various streams in the Pacific Northwest. In all of the articles heretofore appearing, no reference has been made to the lack of a market for this power. Without a market for the energy, the finest water power developments in any section have no economic value. Up to 1910 there had been a rapidly increasing demand for power, which taxed the operating companies to meet. Subsequent to that date the rate of demand has not kept pace with that earlier established, with the result that all of the operating companies in the northwest find that they have a capacity in excess of that needed, varying from a few thousand kilowatts with some of the companies to a considerably higher figure with some of the others. Unless industries are brought into the northwest to absorb a portion of the power already developed, it will be some years before the construction of any new power plants will be warranted.

The Grandeur of Snow-Clad Mountains Reveals Sources of Perpetual Power.

The increase in efficiency of the various electrical machines, the greater distance to which energy can be transmitted, and other advances made in the electrical industry, have all tended to decrease the price paid by the consumer for his energy, and rates all over the country have been constantly decreasing, until those at present in force with the larger companies are only from 35 per cent to 50 per cent of the rates in effect a few years ago. At the present time rates here compare most favorably with those in any other part of the United States. The lighting rate in Seattle of 6 cents per kw.-hr. for the first 60 kw.-hrs. and 4 cents for all over that amount, with a monthly minimum of 50 cents, is perhaps, as low a rate as is obtained in a city of any size in the United States. The

rates in Portland, Ore., and Tacoma, Wash., while slightly higher, are about the same as in Seattle. Power rates to large consumers are, perhaps, as low as can now be had any place in the United States for similar service.

The states of Washington and Oregon are divided roughly into two parts by the Cascade range of mountains, which has an average elevation of 4000 to 6000 ft., with peaks in it ranging as high as 14,000 ft. The two portions of the two states are entirely dissimilar in character, the west side being in a moist climate with very mild winters and comparativly cool summers, while on the east side the very opposite condition exists, it being more of a desert country—hot and dry in summer and cold in the winter. Naturally, there is a marked difference in the precipitation, which varies from 10 in. per annum on the east side to as high as 120 in. per annum on the west side.

It is generally conceded that the streams on the west side of the Cascade mountains, in both Oregon and Washington, present unusually favorable conditions for water power developments. They have a rapid fall and abundant water. Their sources mainly being in perpetual ice and snow, it would seem that the stream flow would be comparatively well regulated, yet every operating plant in this territory needs storage to carry it over the two low water periods which are had on a majority of the streams—one being in February and the other in September or October.

The prevailing opinion among the general public is to the effect that practically all of the streams on the west side have splendid water power possibilities and that it is only necessary to locate one of them, raise the money to construct a power plant, and then figure some method of expending the supposedly enormous revenue derived from the plant. Operating people know only too well that this is far from the case and but few people realize the numerous difficulties which need to be overcome in the construction of the average power development. Usually, they are located in remote places, not reached by even a wagon road. With the great quantity of various construction materials needed and the heavy pieces of machinery which are installed in the power plants, it is almost a necessity to have a railroad to the site. The length of the road, of course, varies with conditions. One plant which is now under construction in the Pacific Coast section, necessitated the building of 56 miles of standard gauge railroad before any construction work was started on the power development. The materials which need to be transported, include, among other things, tons upon tons of steel for the construction of the pressure pipe, for the concrete reinforcement, and other uses in connection with the work; machinery and other equipment weighing hundreds of tons, generating equipment for a temporary plant used during construction, air compressors, head gates, water wheels, generators, and the other incidental machinery required in the power house; the transportation of an immense quantity of powder, cement, food and other supplies and material needed in the construction of a great work of this kind.

In addition to the power plant, there is needed, first, a transmission line to conduct the energy from the point at which it is generated, to the market. This distance varies in each individual case. At a plant which is now under construction in the western country, the length of the transmission line will be 240 miles, one of the longest in the world, and the transmission voltage will be 110,000. The supports for the conductor on this line, instead of being the usual wooden poles with cross arms, will be steel towers built on the ground and having a maximum spacing of approximately 800 ft. Such a line presents unusual difficulties in construction, which necessarily increases its cost. Even with the ordinary transmission line of wooden poles spaced approximately 150 ft. apart, there are many difficulties to overcome. Clearing of the line in itself, in a heavily timbered section, entails a heavy expenditure. All trees on each side of the line which might strike the line if they should fall, need to be cut to prevent an interruption to the service. This means in the northwest, that a very wide strip must be cleared, since the height of some of the trees is more than 250 ft. with an average of perhaps 150 ft. Contrary to the usual supposition, poles for the transmission line oftentimes require to be hauled many miles, although there may be abundant timber adjoining the line. Cedar is the wood most generally used, on account of its lasting qualities, and if it cannot be obtained locally, is often shipped in. The insulators for the ordinary 60,000 volt transmission line are from 18 in. in diameter at the bottom and weigh 27 lb. each. They do not, from the ground, appear to be this size, neither would one think they were so much larger or heavier than the ordinary glass or porcelain telephone insulator, which weigh less than 2 lb. The various camps sheltering the men who are employed in the clearing of the line, digging the holes, erecting the poles and stringing the wire, must all be supplied with food and the various material and equipment needed in their work, and in sections of the country lacking wagon roads the problem presented is a very difficult one. Construction of many miles of wagon road is imperative, and the amount of work involved in maintaining them during bad weather for the passage of heavily laden teams is a big task. The average cost for a high tension line in heavily timbered country using wooden poles, is $4000 per mile, while if steel towers are used, the cost is materially increased.

At the market end of the transmission line is a substation, into which the energy from the power house is conducted at the high tension voltage and reduced to a lower voltage for distributing purposes. Several lines may reach from this substation to other substations located in various parts of a city and from which substations the distributing system radiates to all sections of the city. The equipment in the substation consists of intricate and expensive machinery, again increasing the total cost of the work. The distributing system itself in the ordinary city costs from $8000 per mile in the overhead district where poles are used, to as high as $40,000 per mile for a six-duct lead in the underground section.

It will thus be seen that there are many things to be considered in addition to the power site itself. Further, when plans are being made for the development of any particular project, it is necessary to bear in mind one essential feature in this business, that is, continuity of service. In order to more thoroughly guarantee this, it is advisable to have a steam auxil-

iary plant, if only one power development is owned. The steam plant is often used also to carry part of the load during the peak, and by all of the larger companies a steam plant is had as a "standby" in order to more fully protect their consumers. In addition, storage batteries are usually supplied with a capacity sufficient to carry the entire load of the system for a length of time sufficient to allow the steam plant to be cut in. In Seattle the operating company has $270,000 invested in such batteries which will carry their load for twenty-five minutes only. Under such conditions if an interruption is had for any reason, such, for instance, as a lightning storm, the storage batteries can immediately be cut in and no interruption of service occur. Since fires are kept under the boilers in the steam plants night and day, it requires but a short time to get up sufficient steam to take on the load.

Briefly, these are a few of the difficulties which need be met and solved by all operating power companies. After a system is constructed there are many causes of trouble, all of which need to be constantly looked after and carefully and quickly repaired. Everyone is familiar with the trouble which occurs during an exceedingly heavy wind storm, lightning storm, or a heavy sleet or snow storm, but few people realize, however, the immense amount of trouble and expense such a storm may mean to the power companies. Miles of distributing system may be put out of commission, poles blown over or broken off, wires snapped, insulators broken, and such havoc wrought in a few minutes' time that many thousands of dollars must be

River Mill Power Plant and Amburson Dam—Portland Railway, Light and Power Company.

Puget Sound Traction, Light and Power Company—Electron Power Plant.

The Nooksack Power Plant.

expended to repair, and much time spent to recover from the effects. During such accidents, the advantage of having more than one transmission line, or of being able to transmit energy from more than one plant, is readily realized. If two or more plants are operated by the same company, each having its own transmission line, there is much less danger of an interruption to the service. This is one great advantage of plants being coupled up.

There is a loss of power from the power site to the consumer, of approximately 50 per cent. In other words, of each horsepower available at the power site, only one-half horsepower eventually reaches the consumer, which is about 70 per cent of the horsepower actually generated. The losses are experienced in the water wheels, generators, transformers, transmission line and distributing systems.

Contrary also to public opinion is the fact that the initial cost of a complete water power development is from two to four times the cost of a steam plant of the same capacity.

The light and power business in the western portion of the two states of Washington and Oregon is now transacted by several different companies. The Puget Sound Traction, Light & Power Company has four operating power plants and six steam plants in the Puget Sound region, and supply the entire territory from Tacoma north to the British Columbia line, with energy. Their total rated capacity is 105,440 h.p., of which 75,667 h.p. is in water power plants. This company is under the management of Stone & Webster.

From Tacoma south to the Columbia river, the southern border of Washington, a distance of approximately 125 miles, there are several small cities, all supplied by the Oregon-Washington Corporation, with energy which at present is supplied from two steam plants and one small water power plant. The total rated capacity is 3087 h.p., of which 887 h.p. is in water power plants.

The Pacific Power & Light Company supply a number of cities and towns from Hood River on the Columbia River, east, practically all of them east of the Cascade range.

The section from the Columbia River south to Salem, including Portland, Ore., approximately 50 miles, is supplied by the Portland Railway, Light & Power Company, from three water power developments and seven steam plants, with a total rated capacity of 81,267 h.p., of which 55,307 h.p. is in hydroelectric plants. A new company which has recently entered the Portland field, is the Northwest Electric Company with a hydroelectric plant in the state of Washington of 16,000 h.p. rated capacity, and a steam plant under construction in Portland of 5000 h.p. capacity.

From Salem, south to and including Eugene, Ore., approximately 70 miles, the Oregon Power Company, owned by the H. M Byllesby Company, furnishes all energy from two steam plants and one water power plant, with a total installation of 5616 h.p., of which 666 h.p. is in their water power plants.

The country from Eugene to Grant's Pass, Ore., a distance by rail of approximately 175 miles, is served by several small isolated central station plants. The California-Oregon Power Company supplied the territory from Grant's Pass to the California line, a distance of about 50 miles, included in which is Medford, the largest city in Southern Oregon. This company has in Oregon three water power developments, two of which have a capacity of 8300 h.p. and two water power plants in the northern portion of California.

From the above it will be noted that the largest operating companies in this section find it necessary to have large steam auxiliary plants, entailing an additional heavy financial burden, to carry them over the peak loads, and to practically guarantee uninterrupted service.

The water power plants already developed by the operating companies comprise, naturally, those sites nearest to a market, but does not include some of the better developments which are still available, although a greater distance from the existing markets. Under present conditions of transmission, the greater distance from market would entail but a slightly greater loss, perhaps, two or three per cent, only, in reaching the market with the energy, than is now had from the existing plants.

Notwithstanding the fact that the general idea is that there are no sites available for new developments, some of the very best possible developments, from purely the standpoint of cost of plant, have not been carefully investigated, for the simple reason that no market exists for the power. These powers are on some of the largest rivers in the two states and where the fall in the streams is particularly rapid. Contrary also, to the usual notion in regard to these projects, they are not owned or controlled by any corporation, and many of them can be filed upon by any one who chooses to do so. The interests now in the field do not want such projects for they could make no use of them.

Scarcely a week passes that does not bring to the larger companies, at least one offer to sell a power site, but under present market conditions, it will be years before any interest can be manifested in these propositions. The larger companies recognize this situation, and since anything that will tend to build up the country in which they are operating will redound to their advantage, it is policy for them to assist in every material way in the upbuilding of this section. One company, at least, in the northwest has been cognizant of this situation and has instituted an aggressive campaign to secure additional industrial enterprises. Such a campaign is a new departure in this line of work, but it is realized that if the country is to be more fully developed, that additional manufacturing enterprises must be secured, and particularly is this true when the raw materials, markets and labor are already present. They are carrying on this campaign individually, but are co-operating in every consistent way with the various commercial bodies, and the results obtained will be of much interest to other concerns similarly situated. Extremely low rates or power are being offered as a special inducement for new enterprises. Rates less than $20 per h.p. year for 24 hour power have been quoted to prospective users of large blocks of power.

The power cost of manufacturing per month, assuming a use of 100 h.p. 10 hours per day, with a load factor of 75 per cent. in various cities, is approximately as follows:

White Salmon River Development—The Northwestern Electric Company.

Boston, $937.50; Philadelphia, $839.25; New York, $699.37; Chicago, $629.43; Cleveland, $559.50; Pittsburg, $417.62; Buffalo, $184.91; Seattle and vicinity, $150 to $375; Niagara Falls, $144.17.

The Seattle rate depends upon the amount of power used and the location of the consumer with relation to the generating station.

Springfield Substation—Oregon Power Company.

Power is but one of the four essentials which are needed to build up a manufacturing community. First, are the raw materials; second, the markets, including transportation; third, the labor, and fourth, the power. The conditions existing in this section are materially different from those in the eastern part of the country, where with a dense population, practically an unlimited market, resulting in numerous and diversified industries, the demand for power is extremely heavy, and as a result, streams with but a light fall have been harnessed to supply the needs. Low head developments are the rule rather than the exception, while in the northwest there are no low head developments and practically no attention has been paid to even the larger streams where such developments could easily be obtained.

It is granted that there are unlimited power possibilities on the various streams in the states of Washington and Oregon, but at the same time it must be remembered that until the country is more densely populated and there are more industrial plants located here, there will be no such development of these streams as has taken place in other parts of the United States.

Jupiter's Trial Run.—The electrically-driven collier Jupiter has made a successful forty-eight hour trial run off Santa Barbara. Captain F. M. Bennett, commanding the Mare Island Navy Yard, telegraphed the Navy Department that the ship averaged 14.78 knots an hour for forty-eight hours, or more than three-quarters of a knot per hour above her designed speed. The Jupiter is an experiment in naval construction, and her subsequent performances will be watched with the keenest interest, in comparison with the collier Neptune of the same size, but using the new reduction gear instead of electric dynamos and motors to bring the high speed of her turbines down to a workable and economic basis.

DISPOSITION OF LOS ANGELES AQUEDUCT POWER.

BY WM. VAN DEN HEUVEL.

(The writer brings out certain pertinent facts regarding the Los Angeles aqueduct power project as an aid to a proper and complete understanding of the situation, and presents a basis upon which negotiations for power disposal might be conducted. Mr. Van Den Heuvel is a consulting engineer, with offices at 701 Central Bldg., Los Angeles, Cal. The paper was originally read before the Los Angeles Jovians.—The Editor.)

The power generated under the aqueduct flow is a commodity to be placed at the disposal of the citizens of Los Angeles or Southern California in a manner to effect the most good to the community at large. The Aqueduct Power Bureau, the officials of the city of Los Angeles, in fact those responsible to the people of Los Angeles for the judicious disposal of this power are confronted with the problem as to what form of disposal will produce the most good.

The problem seemingly simple is put under limitations and restrictions, legal, financial, technical and commercial affording an ideal means to do injustice to some of the parties involved. Vitally interested are, at present, principally the aqueduct bureau, the city officials and perhaps existing power companies now engaged in the distribution and sale of power for lighting and various other purposes.

The sale of electric power as a public necessity is now subject to regulation as to rates and character of service, and the city maintains a commission for the special purpose of making such regulations. Rates once approved by this commission are considered to represent a just charge by the company, taking into account all charges and expenses involved in the production and distribution with added thereto a fair profit. This form of supervision protects the consumer against unjust charges by power companies, and insures adequate and satisfactory service under every variety of use of power. The method was first adopted in the State of Wisconsin, soon followed by other states and has helped materially in establishing good business methods and good service on the part of public utilities. The mere fact that the books of these public utilities are subject to examination by the commission has caused the value of their securities to become more sound in the eyes of investors. The jurisdiction of this commission is such as to entirely safeguard the interests of the general public.

The aqueduct power as a general scheme may be distributed in two ways. First, by the use of existing overhead and underground distributing systems as now owned by the power companies; second, by means of new distributing system to be constructed and operated by the city.

The latter arrangement will mean a wasteful duplication of at least certain parts of systems already existing; it further produces competition comparable with competition as now existing between local telephone companies serving the same territory and who, by skillful manipulation have succeeded to graft themselves on the general public, making it pay twice for service which might well be provided by one company, particularly if this company is dependent upon the approval of a commission which has the jurisdiction to enjoin them from doing business unless according to standards established by the commission.

The first method of power disposal has evidently been recognized by the aqueduct board to offer the only practical basis for negotiations. The question still unsettled is, who shall own the distributing system, and present dealings with the power companies have been for the purpose of acquiring such parts of the existing distributing systems as may be necessary for the disposal of the aqueduct power.

The question as to whether or not the city should own a distributing system involves the comparison of the relative abilities of the city and of the power companies as far as the sale of power is concerned; it involves legal points, the city charter in its present form appearing to prohibit the bulk disposal of the power to existing power companies; financial points involving the bonding capacity of the city, and last but not least, public opinion as expressed in a popular vote based upon an intelligent understanding on the part of each voter as to the manner in which interest on outstanding bonds or bonds yet to be issued may be earned without making him pay twice for the same service. It is clear that the voter may be made to bear his share of the expense of power service, first, by taxation or rather increased taxation, second, by his monthly light bills.

It is obvious that the rates for light and power considering the natural growth of the city will only stand for downward revision from year to year. Therefore, no matter whether the distributing system be owned by the city or by the power companies, the individual consumer is not likely to obtain his light and power for less than what he is paying now, unless under revised rate schedules as will be approved by the public utilities commission. The consumer or voter therefore wonders in what manner his taxes may become affected by the construction of a municipal distributing system, granting the fact that it cannot increase the tax rate on the ground that the distributing system would first of all be self-supporting. It thus remains to decide whether the city is able to distribute power cheaper than the existing power companies purely as a matter of business ability, not of profits since the amount of profit in either case is clearly defined by the regulations of the public utilities commission.

The existing power companies operate their systems as a matter of business for the profit obtainable therefrom; they have set themselves certain standards in the employment of men and salaries paid; they have defined policies followed in securing new business. In the nature of things, it is the object of their business organization to reduce expenses to a minimum, thus causing returns to be as large as possible. The men employed in and in charge of the various departments are selected on their merits only, and are usually able to retain their positions as long as they prove valuable to their employers. They are not subject to civil service commissions or dependent upon political influence for the continuity of their services.

The civil service form of employment was devised in connection with the management of municipal affairs as a first step to avoid political influence in the selection of men for public offices. Civil service has as yet no jurisdiction over most of the executive offices, and this is entirely due to practical conditions

which make it well nigh impossible to fill such executive positions through examination and competition. While some new form of city charter may place the city in a better position to conduct the business of its numerous branches on sounder lines, it does not establish that the city can distribute power cheaper and better than corporate organization.

The organization on the part of a municipality for the purpose of getting new business, is usually small and considered as only incidental rather than of great importance. The comparison here with the corporate company brings out the fact that often a municipally owned system is liable to suffer from stagnation, extensions are made according to need rather than in anticipation of future requirements. Extensions must be financed through additional bond issues, under approval of the people. Recently in the State of Kansas, a municipally owned electric lighting plant and distributing system was turned over to private interests for operation, while originally, the system was built by private capital, afterwards acquired by the munipality. It proved, however, that operation by the private company largely increased the amount of new business acquired each month.

The matter of future extensions and the plan of financing such work, is quite similar to conditions now obtaining in the water department and under discussion with the Los Angeles Realty Board. The question now pending, involves proper charges for new water service connections. It has been advanced that there exists an injustice in making the charges for water to old consumers bear the cost of such extensions rather than to cause the new consumers to pay for the expense involved on a front foot basis of assessment. This theory was advanced recently by one of the city officials, and a certain amount of explanation was given for the theory. However, it was omitted to mention the fact of benefits to old consumers through the addition of new connections, and caused by the gradual enlargement of the system which brings along a reduction in the cost of production, meaning that with the growth of a city, water can and should be supplied at gradually lessened rates. Levying of assessments, places new consumers on a basis different from existing consumers, and if there exists justification for a difference, then it should be introduced by a means of the cost of water, not by means of a scheme of financing different from and in addition to the existing method whereby bonds are issued for new funds needed, and in the event that such moneys are not available from the gross returns of the total water system.

These arguments apply directly to extensions necessary for the power distributing system. It would hardly appeal to public opinion to acquire the existing and required distributing system through assessment of the individual consumers of the territory just served, while the plan to finance extensions in this manner would establish a precedent in the business of distributing electric power in cities. The assessment plan is now used in the distribution of power to remote agricultural districts, though the money thus advanced by the consumer is returned to him in the form of discounts on his monthly bills until the power company has thus paid for and acquired the extension.

Applying the refunding idea to an assessment plan, we get a tangible business proposition for the power distribution, while under the adoption of this plan with extensions of mains by the water department holders of large tracts of land for subdivision would find themselves obligated to finance these extensions for the length of time required to wipe out the principal through discounts applied over a limited period of time.

The aqueduct power obtained from a series of water power plants located a considerable distance from Los Angeles must necessarily be produced at a cost which will compare favorably with the cost of manufacture of electricity by means of steam plants such as are now operating in Los Angeles and vicinity. To the layman it seems obvious that the power from water that would otherwise go to waste, is cheaper than that produced with steam plants. The fact is not quite so obvious when it is realized that the investment in a water power plant and transmission lines may be four to five times as great as in the steam plant of the same capacity. When in addition to this we have a condition whereby the load on a power station lasts only a few hours each day, it becomes evident that during a greater part of the time, most of the machinery is idle; that therefore it pays to have as little money invested in the power station as possible in order to reduce interest charges against the investment.

Applying the above facts to conditions obtaining in Los Angeles, and further applying them to the considerations in the disposal of the aqueduct power, it becomes pertinent how the cost of aqueduct power compares with the cost of other power now used by the power companies. In order to make such a comparison fair, we must select power similar in character of service which it provides. It is logical to assume that if the city of Los Angeles is now lacking in power facilities, this lack will make itself felt during the hours of maximum demand; that therefore, the immediate value of the aqueduct power will be as peak load power. Whenever peak load power demand exceeded the capacity of the existing power stations, it has become necessary to provide additional power units, and under the most approved and modern methods, steam turbines of large capacity have been used. Comparatively small additional investment at the power station places power companies in the position of meeting satisfactorily these peak load demands. For this reason it appears that really aqueduct power may not be very desirable to fill present peak load shortage in the demands of the city.

The majority consumer is essentially a peak load consumer using power for only a few hours per day. We thus find that most consumers are not directly interested in or served to advantage by the introduction of aqueduct power for this purpose. In order to make this point still clearer, we may add that all power companies now have surplus power available for sale during all hours other than peak load hours; that as far as actual need goes, they are not desirous of buying aqueduct power for distribution unless it can be had at a figure comparing favorably with their own cost of production during whatever period of use.

The above is intended to illustrate that it will be a matter of best advantage all around, with benefits to the community at large, that the aqueduct and ex-

isting power companies co-operate in a manner whereby the power needs of the city are filled through a combination of the aqueduct system with existing systems. This combination to refer not only to distributing systems but to generating systems as well. Such a combination would insure the use of aqueduct power where it would be of most advantage, while steam power would be used whenever the physical facts proved to be more advantageous. The suggested co-operation between the aqueduct and the power companies would make necessary an equitable arrangement, compensating each party to the extent of the service rendered, whether in the capacity of a power producer or, as a power distributor, and the board of public utilities by means of approved rate schedules now effective, would be the medium of control of such an arrangement.

It would seem that negotiations to date have failed, principally due to the difficulties presented by the basis upon which these negotiations have been carried on. It is believed that there has been a tendency on the part of the aqueduct to depreciate the value and importance of emergency service, such as would have to be rendered by other generating systems now operating in the city, and which would have to take the municipal load during interruptions. The capital outlay for emergency service is considerable, and it would be difficult to arrange for this unless under a plan of co-operation between all parties concerned. By co-operation, the provision of emergency service would be mutual, and the value of emergency service would be a tangible proposition. In view of this fact, the aqueduct power should be sold for less than what the power companies can produce power for themselves.

While the development of the aqueduct power as a matter of economics is a most desirable undertaking, it seems hardly fair to expect this development to be from the outstart, not merely self-supporting, but highly remunerative also. Marketing of power is the vital problem in the development and success of the enterprise, and we might, in these negotiations, come face to face with the perplexing problem of expecting power companies to acquire additional power at too high a cost, and at a time where the market within the city limits is not really in dire need of it. It has been stated lately in some of the newspapers that the profits due to the sale of aqueduct power may go far in paying interest on aqueduct bonds in addition to interest against aqueduct power bonds. If this argument is made to apply to the disposal of aqueduct water for irrigation purposes, and in the charges to be made therefor, it becomes clear that an apportioning must be made of the total combined cost of aqueduct and power development to water and power charges respectively. No figures have appeared thus far stating what part of the expense of the aqueduct construction may rightfully be charged against the production of power in addition to the mere cost of power plants and transmission lines. Pending such considerations, we are face to face wtih the creation of a possible revenue from power sales, provided that a fair arrangement can be made causing immediate returns.

It is suggested that as a future basis for negotiations, present rate schedules approved by the public utilities commission be subjected to a pro rata division; that the city, in co-operation with existing power companies, agree to take a percentage of the gross returns for such total service as it may be desirous of rendering to any or all of the power companies; that this percentage be in terms of the physical value of the part of the equipment involved in such service; that the percentage be chosen to duly allow for the character of service, if necessary arranging for emergency service by penalizing the city for interruptions at the rate of from $500 to $1000 a minute; also that the percentage in fairness to all parties be made to account for the amount of risk involved in the particular service rendered and the investment required therefor.

The above basis would make the city substantially a power distributor, receiving compensation to the extent of service rendered. It is realized that a somewhat similar plan has already been proposed under a division of profits. It is evident that it would be considerably more difficult to negotiate on this basis than on the one suggested herewith.

By metering the total aqueduct power as supplied to the power companies and computing the percentage which it represents of the total meter output of the company could easily be determined, and a speedy accounting on the books of the power companies would be possible. The accessibility of the power companies' books to the utilities commission constitutes a safeguard of the people's interest in this direction.

San Fernando Valley at night is now a blaze of light from Lankershim to Owensmouth. The ornamental system previously installed in Van Nuys and Owensmouth has been extended to include the entire length of Sherman Way. On Saturday, November 1st, the Newberry-Bendheim Company completed the installation of the ornamental posts under its contract, which, with those previously installed, brings the number of posts installed up to 415. The posts are of cast iron, and are modelled after the design used on Hill street, Los Angeles. They are provided with five lights each in the towns of Van Nuys, Marian and Owensmouth, and the services are all underground in these centers. In the territory outside these communities the posts are provided with three lights, and the feeders are installed on a pole line on private property, the services being underground, so that the effect of a complete conduit system is by no means destroyed. B. F. Kierulff & Co. has the contract for an additional installation of 188 posts on what is known as the Ventura Road, which is part of the state highway system. Altogether the effect at night is startling, and appeals to one as a marked advance in suburban life. The distance between Lankershim and Owensmouth is approximately 15 miles, and this entire distance is illuminated superior to many more metropolitan districts. The Llewellyn Iron Works furnished the posts and the Southern California Edison Company supplies the current and will provide regular maintenance.

ELECTRICITY IN DRIVING THE KOOLAU TUNNEL, HAWAII.

BY R. REID.

(Touching upon irrigation methods employed in the Territory of Hawaii, the author, in referring to a particular project on Oahu Island, describes in an interesting manner the temporary electrical equipment used in connection with driving a 3-mile tunnel through the Koolau Mountains, through which a flow of 50 million gallons of water per day is expected.—The Editor.)

The principal industry of the Territory of Hawaii consists of growing cane sugar and milling the canes at the various sugar factories to extract the raw sugar which is shipped direct to the refineries on the Bay of San Francisco or routed by the American-Hawaiian Steamship Company's huge freighters via the Tehauntepec railroad to the Eastern States. The canes are raised either by the dry land method which is rather restricted due to uncertain rainfall giving small tonnage yield per acre of cane, or by

North Portal, Koolau Tunnel.

the usual and highly developed methods of irrigation now extensively practiced in Hawaii. In the majority of cases the plantations lie along the coast and water is brought to the thirsty cane fields, from the mountainous regions where the natural run off, rainfall and seepage is collected and conveyed by means of canals, tunnels, pipe lines or flumes to the distributing reservoirs located on the plantation area. Another method of procuring water, although usually one more expensive than the above is by means of steam or electrically driven pumps.

This latter method is used in supplying water for the Oahu Sugar Company's plantation located on the island of Oahu, about fifteen miles north of Honolulu and the total pumping capacity of the combined units here averages sixty million gallons per day, which is raised to various elevations.

For the purpose of increasing the area under cultivation the above company intend reclaiming land lying about 600 ft. above the sea level and in order to irrigate has decided to bring water from the eastern part of the island through the Koolau range, by means of a main tunnel and several miles of lateral tunnels on either side of the range. In order to carry on this project the Waiahole Water Company was formed. The main tunnel when completed will be three miles in length and has a cross section as shown in the accompanying illustration. As is usual in driving a tunnel of this nature where an adit cannot be made along its length or shafts driven from the upper surface, headers can only be worked from each end and the driving of the Koolau tunnel is proceeding under the latter method having north and south portal heading.

The Koolau mountains extend along the eastern side of the island of Oahu in an almost unbroken precipitous range and on the eastern side precipices as high as 2000 ft. are formed. Moisture laden clouds blown by the N. E. trade winds in from the vast

Interior View Oahu Company's Sugar Mill.

expanse of the Pacific, bank up against this range and condense on the cold mountain tops causing most of the run off to be toward the eastern side of the island.

When the Koolau tunnel is completed it is estimated that about 50 million gallons of water per day will be conveyed through it to the cane fields on the western side.

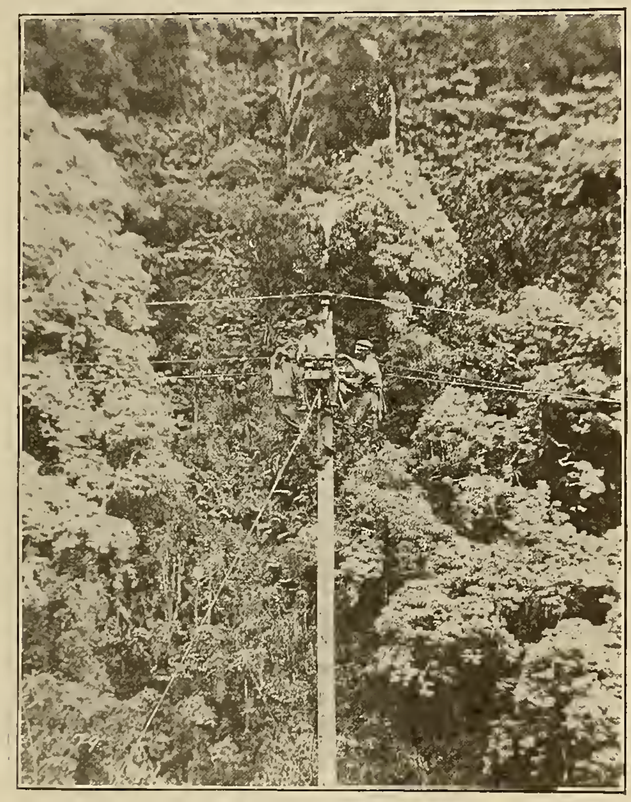
Before electric power installations were ready the drilling was done entirely by hand drills, some 300 ft. on the north side and about 2000 ft. on the south portal being driven in this manner.

The machinery when completely installed at the south portal will consist of the usual necessary equipment for tunnel work; air compressor, blower, drill sharpener, compressed air drill and a number of machine tools, such as lathe, shaper, band saw, rip saw and drill press. Besides these, motor driven machines

a motor generator set is to be installed for charging the storage battery locomotives, which are used in hauling the mucking cars, running on a narrow gauge railroad from the portal to the header and to the dumps.

A 100 h.p. 440 v. three-phase Allis-Chalmers induction motor drives the air compressor which is an Imperial type 10 Ingersoll-Rand machine, with intercooler and has a capacity of 375 cu. ft. per min. at 100 pounds per sq. in.

From the compressor receiver a 6 in. galvanized iron pipe carries the air to the header pneumatic drills. Two machine drills are used in each header and are mounted on an iron bar placed across the header and braced with wedges and in this way holes to receive the dynamite charge are drilled in to a depth of 7 ft., by using sets of drills varying in length from 3 to 7 ft. A round of five holes is drilled, the charges placed and at a safe distance back from the header a switch is thrown to shoot the round.



Transmission Lines.

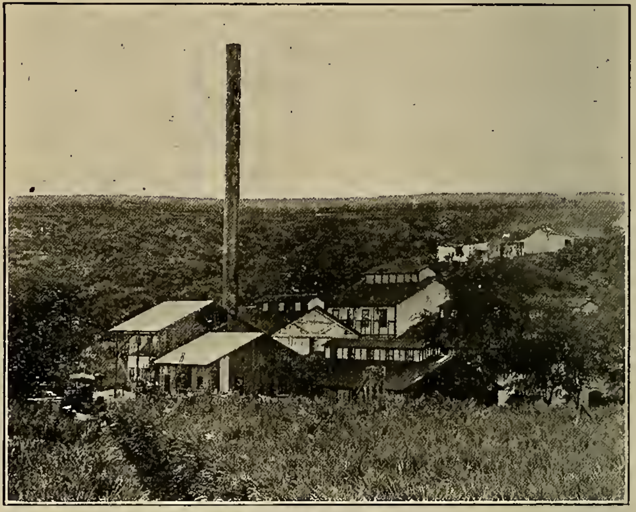
The blower is driven by a 15 h.p. 440 v., three-phase Allis-Chalmers induction motor and at the entrance to the 16 in. pipe line which runs into the tunnel to within 100 ft. of the header, there is an arrangement of small doors by means of which a suction can be produced such as is done after shooting the round, or straight blowing can be continued while the direction of rotation remains unchanged.

The drive for the machine shop consists of a 20 h.p., 440 v., three-phase Allis-Chalmers induction motor, belted to the line shafting from which all the machine tools are driven. A 15 kw. motor generator set 440 v., three-phase to 110 v., d.c., is used to charge the Edison 63 cell storage battery units of the Jeffery electric storage battery 3-ton mine locomotives. These are of the narrow gauge single truck double motor type.

Several 15 h.p. 440 v., three-phase Allis-Chalmers induction motors to drive concrete mixers, sand rolls, etc., will be installed later when work is began on the concrete lining of the tunnel.

All of the above drives will receive power from the south portal substation consisting of 3-60 k.v.a. single phase 11,000/440 v., oil insulated air cooled Allis-Chalmers transformers connected. Burke high tension (11 kv.) air brake switches, choke coils, lightning arresters and fuses are placed between the transmission line and high tension bus bars.

The 11 kv. transmission line extends from this substation six miles to the power house and is composed of 30 ft. cedar poles with cross arms and ridge pins making a triangular construction; the distance between wires being 40 in. and the average span 160 ft. In places where larger spans were necessary double cross arming was employed and the poles on either end well braced by side and head guys. The line is light construction, being No. 4 copper throughout.



The Power Plant.

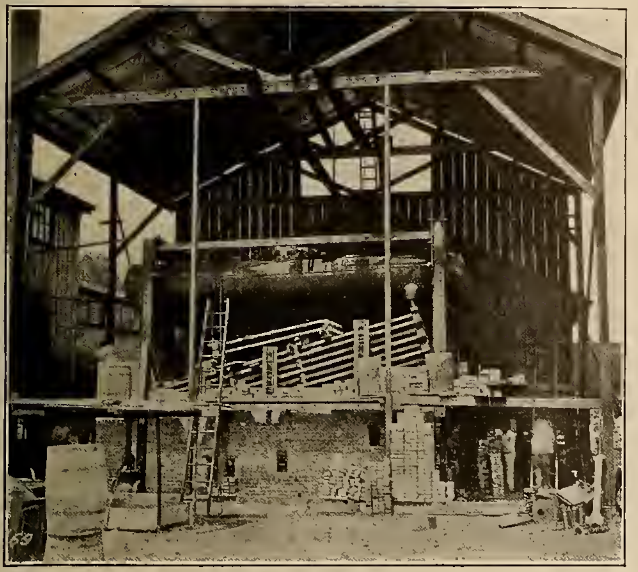
The power house is located on the Oahu Sugar Company's railroad about six miles southwest of the south portal. At present this small isolated plant is composed of a complete equipment for steam generation. Two 250 h.p. Babcock and Wilcox boilers with Foster superheaters supply steam at 175 pounds per sq. in., for a 300 k.v.a., 2300 v., three-phase, 60-cycle, 3600 r.p.m. Allis-Chalmers steam turbo generator. Fuel oil is used and supply storage tanks are located close to the railroad.

The building is a wooden frame structure, consisting of a boiler room, 37 ft. x 30 ft. and 33 ft. high, and a turbine room 37 ft. x 30 ft. and 24 ft. high, each of the parts having their sills on separate light concrete foundations. The boiler room gable wall separates the boiler room from the turbine room as shown in the accompanying illustration.

The turbine runs condensing, the condenser being located in a concrete lined pit directly under the floor of the turbine room. The foundation for the turbo-generator consists of two supports one on either side of the condenser pit and in this way the whole machine straddles the pit and sufficient room is afforded for the 16 in. exhaust pipe valve, and two expansion joints connecting the turbine with condenser.

The steam line is 4 in. and between the separator

and the main header has a bend and valve. The auxiliaries are all piped from the same header. In starting or running light load the turbine exhausts to the air and for this purpose has an atmospheric exhaust and an 8 in. pipe line to the exterior of the building, where an exhaust head extends above the roof. The bearings are oiled throughout by a small steam duplex pump mounted on the bed plate of the turbine.



Boiler Installation.

A Wheeler surface condenser, with air pump immediately under it is used and 100 gal. per min. circulating water is pumped from the sump of a nearby high lift pump by means of a 15 h.p. Kerr steam turbine directly coupled to a double suction 6 in. centrifugal pump.

The exciter is also driven by a Kerr steam turbine, this unit being 15 kw., 120 v., 3600 r.p.m.

Three 125 k.v.a., 2300 to 11,000 volt single-phase oil insulated water cooled raising transformers are installed in the turbine room. The bus bar construction

Engineers' Camp, Koolau Tunnel Project.

is of 1¼ in. black railing pipe and surmounts the transformers carrying a single set of three-phase bus bars for the high and low tension and having braces at right angles to the top cross bars, extending out to the switchboard. The latter for this small plant consists of a single panel on which are mounted the meters for both generator and exciter and also the oil switch between the incoming leads and the low tension bus. On the high tension side between the line and bus bars and just outside the building wall, the air brake switches, choke coil, lighting arrester and fuses are mounted. These are of the same type as mentioned before being Burke horn air switches.

On the north portal heading hard blue lava rock was encountered at a short distance from the portal and an Ingersoll-Rand Imperial type 10,375 cu. ft. per minute, air compressor was installed and belted to a 3 cylinder 150 h.p. gasolene engine having a clutch between the driving pulley and engine shaft. It is intended to replace this temporary installation later with a 100 h.p. induction motor drive. The machinery for the north portal was ordered in almost exact duplicate to that for the south portal, but at present only a part of the consignment has been installed. At this portal a 27 million gallons per day flow of water was recently struck in the main header and since there is sufficient head here for developing hydraulic power to operate all machinery for the north portal with a minimum of about 6 million gallons per day flow the pole line has only been constructed as far as the south portal.

All of the machinery is installed in a substantial manner, although its use will be only temporary as the company intend to salvage it on the completion of the Koolau Tunnel.

THE JOVIAN COMMERCIAL DIVISION.

BY ELL. C. BENNETT

As expressed in aptness and verity by one Jovian—"The Jovian Order for many years has been a sleeping giant." To convince that this condition of somnolence is truly of the past, that the giant has awakened to full realization of the possibilities inherent in his strength, one has but to study the progressive measures adopted by the Eleventh Annual Convention of the order in New York City.

These included many plans for the further propagation of Jovian goodfellowship, fostering of the social features, and one enactment of particular merit, of splendid possibilities bearing upon the practical side of Jovianism. This was the authorization of a Jovian Commercial Division. It is with the object of giving briefly the reasons for and an explanation of that plan that this article is written.

The title "Jovian Commercial Division" is in a sense a misnomer in that it might be taken to imply a "division" of the Jovian Order, whereas it is not intended at all to accomplish that catastrophe, but, on the contrary is created for the express purpose of cementing the members of the order into one indissoluble unit, by giving those members a practical reason, a tangible object, for so coming and remaining together.

The commercial division is a "division" only in-so-far as the Jovian central offices are concerned. It means simply a concentration of Jovian effort along certain well defined lines guided by a division of the central offices which has only that work to do, and its salvation, doing it successfully. It is purely the establishment of a concrete force, a means, to surely accomplish the practical things Jovianism has espoused for years, without interfering with the continued growth and expansion of the social phases of the Order.

Briefly, the organization to accomplish this consists of the reigning congress in the capacity of a board of directors, Mercury as active executive, or general manager—these men without salary—and two clerks under pay, the total maximum annual expense being $2500.

It cannot be otherwise than the hope of every man with belief in the practical value of co-operative effort, and with ambition for the permanency and added glory of the Jovian order, that a legitimate means of further financing the commercial division will be soon found by the Twelfth Jovian Congress. The generosity of the Jovian order itself in its donation to the entire industry, Jovians and others, of its funds and organization is an inspiring precedent, particularly so when it is remembered that this comes largely from the rank and file, from men of moderate income and comparatively humble position.

Commercial Division Plans.

First: A systematic campaign to establish a Jovian League or Chapter in every city having a Jovian membership of fifteen or more.

Second: A plan to provide on a self-sustaining basis permanent club rooms for each Jovian League. These rooms to be regulated in size and expense to meet the present and prospective demand upon them. To be supplied with electrical publications, magazines and libraries, writing facilities, chess, checkers, billiards, where the membership justifies such an expense, and the usual requisites of similar club rooms. Rejuvenations, joviations, luncheons can be held in these rooms. To the traveling Jovians they will prove a particular boon.

Third: Schools in connection with the club rooms, to meet the need of better instruction of salesmen of electrical supplies, devices, apparatus and power. This plan to be operated in a similar manner to that now successfully employed by a few central stations.

Fourth: Co-operative electrical display rooms in business and residential sections of cities.

Fifth: An employment bureau where will be listed with a brief outline of their experience and qualifications all those Jovians who are out of employment or seeking an opportunity to better positions they hold. Also a list of positions for which men are needed. To insure the success of this bureau, information given to it will be considered confidential and possible contracting parties will not be brought together until the sincerity of both is established. Information will be kept in card file form, cross-indexed.

Sixth: A campaign for more uniform and efficient inspection of electrical construction. This is to be handled by local Jovian committees of mixed interests under suggestions from the central offices and in co-operation with local inspectors.

Seventh: A plan to provide licensing of electrical contractors where such action is needed. This work to be prosecuted through local committees.

Eighth: A campaign to secure practical co-operation of architects with a view to having them both specify proper electrical material, and see that such specifications are fulfilled to the letter. This also to be worked out by the aid of local, mixed committees.

It is well to add here that the three last named plans were approved and authorized by both the Ninth and Tenth Annual Conventions of the Jovian Order; but, through lack of such a tool as the commercial division were never prosecuted after going to committee.

Ninth: Preparation and distribution of educational matter relating to the uses of electricity—simple definitions of its terms, etc.—upon which the general public should be better informed.

Tenth: Encouragement of and assistance in organizing local electrical expositions.

Eleventh: Providing speakers, on electrical and public utility subjects, for clubs and civic bodies.

Twelfth: Supplying the daily press with pertinent news on current electrical topics.

Thirteenth: Providing an "Electrical House" on a co-operative display basis for the Panama and other expositions, state fairs, city exhibitions, etc. These houses to show not only all the usual types of electrical devices with which the public are familar, but to be so constructed that they will exhibit by cut open base boards and walls correct and sufficient wiring and placing of outlets.

It is obvious that the commercial division cannot hope to accomplish all of these and other plans within a short space of time. It can and will, however, show progress in the prosecution of them and eventually put them all into effect. If a plan is found to finance the division to a point where greater force can be put behind each movement than its present financial limitations will allow, where more and heavier ammunition can be furnished its local organizations, then, when we consider the tremendous power wielded by scores of these local chapters driving forward with unity of purpose, we can confidently expect early and highly efficient results.

The aqueduct power distribution problem now seems nearer solution. Mr. R. H. Ballard, representing the three lighting companies, has reopened negotiations with the City Council on proposition number two, known as the Agency Plan, submitted to the Council's Aqueduct Power Committee several months ago. The scheme, as now formulated and which has been clarified of all doubtful features, proposes the employment by the city of the power companies to distribute aqueduct power over existing systems, which are to be leased to the city. The latter will thus deal directly with the consumers, contract with them for light and power, and fix the rates to be paid by the consumers. The companies will distribute the power, and be paid for this service at a rate to be fixed by mutual agreement. Included in the scheme is the proposal to submit to the California Railroad Commission all phases of the proposition, and to this end Mr. Ballard and City Attorney Stephens have been authorized to confer with the commission to ascertain if, under existing conditions, it can be induced to participate in the solution of the problem. The scheme further includes ultimate ownership by the city of the distributing systems, but the details of this portion of the project are not yet worked out. There is a marked feeling of confidence that the power companies are willing to meet the City of Los Angeles on any reasonable proposition.

THE SYSTEMATIC CANVASS.

BY R. B. MATEER.

[Touching upon the losses occasioned by haphazard methods, the author points out the advantages of systematically keeping in touch with customers and its influence upon improved load factor.—The Editor.]

Have you systematized your new business organization; do you know your cost per dollar of revenue contracted? Are your records up to date? Do you know how many of your consumers are using electrical appliances? Are you sure each consumer secures what he is paying for—"good service?" Are you anxious to improve the load factor of certain classes of business? When your directors ask for information, is a reply given them that is merely an approximation? Systematic commercial effort and thorough canvass of all consumers solved many of the great difficulties for other aggressive companies. Why not for you?

A famous student of public utilities recently estimated that the sum of sixty million dollars was wasted annually in the electrical industry in competitive effort, without advancing materially the use of electricity for domestic, rural, and industrial purposes. That such a sum is each year expended, is not surprising, when it is considered that the campaigns undertaken in behalf of many companies have as their object, merely the securing of contracts—business that may be connected to the distribution systems, with a view of forcing an early sale of one company to another at a good profit.

If, prior to the indiscriminate signing of contracts, such funds as are normally appropriated for commercial sales effort, were disbursed in a comprehensive canvass of the territory served, business of value, possessing good load-factor and high power-factor would be encouraged, and the analysis of existing conditions would determine along what lines of endeavor sales effort is productive of a maximum return in revenue. Not only will a careful canvass be of value to a new competitor, but it gives to the existing utilities a means of analyzing the local needs; of establishing a sympathetic understanding with its customers; for investigating carefully that phase of public sentiment, which whether inspired by poor service or false statements, so quickly forms the basis of discontent. Public opinion may be moulded, and so become one of the greatest factors of safety to capital and management. No methods are so effective for moulding public sentiment as those of an honest, conscientious investigation and educational canvass of the present consumers.

Methods.—Lighting companies have attempted in various ways to examine the territory supplied with their commodity. Some employ those who, in a haphazard manner, cover that portion of a community where new contracts may be procured. No reports are made, except the filing of the agreement with the prospective customer. Others attempt the canvassing of each section, by house-to-house solicitation. The salesman returning to the office a card bearing the name of the occupant, his address and the service used. Such cards are generally filed; those considered as prospective business on the right, like the sheep, but those at present supplied are as goats, placed on the left, and promptly forgotten. A few aggressive companies, knowing the value of service and the cost of connections, are anxious, not only for the new consumer, but encourage additional business with present users, by placing a premium on such revenue-producing load as occasions no service expense.

Of the three methods of accomplishing results, the first two may be classed as responsible for a large portion of the sixty million dollars annual waste; the third, as producing returns at least equal to, and usually many times the expense incurred.

The Practical Way and Its Value.—This plan consists of a house-to-house solicitation of every consumer and non-user of service, at least three to four times each year. Under such a system daily reports are filed by the salesman; each call is noted; the correct address and the name of tenant or owner also. Should the occupant be using oil, gas, or electricity, it is recorded, also whether the house is new or old, wired or unwired, the residence occupied, the service supplied, and the appliances in use.

From these reports a definite knowledge of the service, how and for what used; of the possibilities of additional business by the sale of electric iron, percolator, toaster, washing machine, range, etc.; of the lighting conditions, whether efficient, or of a type productive of such complaints as "high bills or poor service"; of public feeling co-operative or unfavorable, and how corrected is readily obtained, all for the expense generally chargeable to new business effort—moulding public opinion.

Such data can only be secured by conscientious endeavor on the part of courteous, intelligent salesmen, who believe in the value of their commodity, and whose loyalty to their firm is founded on the square deal, stimulated by appreciation for honest effort and evidenced by substantial remuneration.

Such comprehensive records are not secured without cost and a certain fixed expense is necessary to maintain in service, ever alert for good profitable business, the efficient salesman in charge of a district. A reasonable sum must be included in the yearly budget for clerical labor, that the records each day may be transcribed on appropriate cabinet cards, that lists for advertising purposes may be prepared, a careful check obtained of all appliances in use on a distribution system, and that reports on the cost of each class of commercial effort, residence, mercantile, exterior display, rural development, and industrial power may be available in determining its relative profitableness, and the advisability of increased appropriations determined.

N. E. L. A. 1915 Convention to be held at San Francisco will be attended, it is expected, by 1500 members from east of the Rockies.

The Exposition Fact Book is issued for free distribution by the San Francisco Chamber of Commerce, among those who may be instrumental in having conventions held at San Francisco in 1915. It contains considerable information of importance regarding advantages offered, railway routes, hotel rates, facilities and so forth.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE
Technical Publishing Company

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E. B. Strong, President and General Manager
A. H. Halloran, V. P. and Managing Editor
Robert Sibley, Treasurer and Editor in Chief
C. L. Cory, Secretary and Special Contributor
A. M. Hunt, Director and Special Contributor

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1890.
Entry changed May 1. 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

The Illuminating Engineer

We live in an age of specialization, maybe super-specialization, and so it was surprising to hear a recent lecturer on "Scientific Salesmanship" complain that he could not secure satisfactory advice upon an illumination problem although many wiring contractors, that is to say, their estimators, had been consulted. To the credit of the wiring contractors of the city in which this occurred, it should be stated that those consulted did not represent the leaders among the craft.

Moreover, the prospect knew what he wanted, but was not quite sure that it would work. He wanted his own proposal endorsed. But the system proposed did not come within the experience of those consulted, and so they suggested something which they knew would work, and were ridiculed for their well-intentioned effort.

Now the scientific salesman, if nothing else, is a specialist. Hence the surprise that a leading exponent of that science should expect a wiring estimator to advise on an engineering problem. One does not call in the bricklayer and ask him to plan the building or to pass upon proposed architectural features. That is the work of the architect, and be it noted in passing that the architect himself does not pose as a "know-all," but calls in other engineers—constructional, plumbing, electrical, heating and illuminating—to consult with him.

The reason that the architect does not handle the job alone is, to put it plainly, that it is beyond him. Yet he loses nothing by that admission. Progress in all branches of engineering, with the consequent changes, is so rapid that unless one specializes it is impossible to keep up with it all. The architect is the high priest of the crafts and directs them so that their combined effort is harmonious and complete.

It is but 34 years since the first small incandescent lamps for interior lighting were marketed, and but a few years since the high intrinsic brilliancy of the then new metal filament, or tungsten lamps, necessitated further considerations than those of illuminating efficiency, if the vision of the race was to be conserved, while artistic considerations and period treatment called for a still wider study of the science of illuminating engineering. With such a rapid growth and development complete knowledge was insured only by specialization.

It is the aim of the illuminating engineer to ensure economy of operation, combined with the relative artistic appearance of lighting installations which will at once conserve vision and permit the effective carrying out of the work for which the system of illumination is designed. The day has passed when it can be rightly said that the layman, with but a few simple rules and scientific reflectors can be his own illuminating engineer, except in unimportant installations. This is now the work of a specialist—a scientific salesman—and the more this is investigated, the more convincing it becomes.

The illuminating engineer is unprejudiced and able to devote his whole time to illumination problems, and because he does, and is available for this work, everything possible should be done to encourage him. At present his existence is not so well known that the layman uses his services to any extent; but he is

now necessary, and it is the part of wisdom that we all encourage him in his work.

Stale Statistics.

It was indeed interesting to read the report on electrical machinery and apparatus recently released by the census office and to note the remarkable increases everywhere as compared with the census last previous. Outside of that, though, the report had no value; the comparison made, the advance noted, and then the disappointment upon finding that the information was being published just four years too late.

It was as though one had read that the Government troops were defeated by rebels at Nicaragua or that Prince Ito of Japan had been assassinated by a Korean at Harbin, Manchuria, and then found to his disgust that the newspaper was a '09 edition.

Yesterday's newspaper is thrown away because the "news" is stale, and therefore comparatively unprofitable, but Government sends out to the greatest industry for its age, on earth, four years old statistics which at that late date are practically valueless. Certainly their value is not proportional to the cost of their compilation, leaving the excessive cost of publication out of the question.

Does the information published actually represent five years' work of a sufficient and skillful staff, but not unwieldly, working at the highest degree of efficiency? If so, it is certainly not worth while.

An intelligent study of reliable, up-to-the-minute statistical information will, if consistently and persistently carried out, undoubtedly result in tangible remunerative advantages. Statistical information widely and carefully gathered, properly presented and promptly disseminated, relative to conditions and prospects, and possibly actual requirements, has a strong influence in maintaining a reasonable and stable equilibrium between production and demand, with the consequent assurance of reasonable profit to the producer and just prices to the consumer. It would seem that statistical commercial knowledge is a factor calculated to eliminate from commerce any undesirable influences of uncertainty. In the past it has been deemed advisable, in order that accuracy be assured and authority invested, that such statistics be compiled by Government, but if we consider the high morality of the electrical business, the co-operation existing in all branches, and the wonderful organization which permits the prompt compilation of data of interest and its prompt dissemination, it would certainly appear that we have outgrown Government's unwieldy methods; could readily dispense with stale statistics and unprofitable.

Agricultural statistics are certainly not delayed, for, if they were, they likewise would be valueless. So important is this information considered that it must needs be anticipated, and estimates made and published in advance, as to the probable yield of the various crops, and such statistical estimates, and the reports of actual yields, are in great demand by farmers, prospective settlers, capitalists and others. They would be practically valueless, though, if published in 1913 to cover the crop season of 1909. The farmers have no organization which would permit them to collect and publish reliable nation-wide statistics. But surely organization of private interests does not justify Government neglect, and if it does, then why not entirely eliminate statistics musty with age and rely, for it actually is possible, upon the published reports or operating and manufacturing associations for reliable data brought right down to date?

Attracting New Industries

The Pacific Northwest is facing a peculiar power situation. In most Western communities the demand exceeds the supply and the problem is to finance new developments and extensions. But many of the great hydroelectric systems of the Northwest were built by courageous and progressive pioneers, actuated by the belief that utilities should precede population in a region of such rich natural resources. As a new railroad may be built to tap virgin territory, so they anticipated the power needs of this rich empire. Cheap power in abundance they now offer to all comers. Until this surplus is fully utilized the requirement would seem to be not that of developing more power, but of attracting more users.

This in turn means the establishment of new industries, not a few spectacular enterprises, but steady consumers. Electric smelting, for example, has been widely advertised as a power-consumer, but the researches of the United States Bureau of Mines show that, except for the smelting of iron ores and the manufacture of aluminum and the ferro alloys, it is still an experiment. Even the electric smelting of iron ores has not yet proven a commercial success on the Pacific Coast. So whatever market may be created from these sources is too distant to warrant present consideration. The much-heralded processes for fixing nitrogen are sufficient where atmospheric nitrogen is one of the few natural resources that the country possesses and where power is worth only from three to four dollars per horsepower year. But with their wealth of raw materials from mine, forest and farm greater things are possible in Oregon and Washington.

Labor alone is lacking. The problem of modern industry is not the distribution of the money supply, but the man supply. Money follows men. The home is the first principle of production, distribution and commerce. The automobile industry naturally gravitated to those centers of population where men were ready and willing to work and could induce immigration from more men like themselves. Here is the opportunity that should be cultivated by the great power companies of the Northwest. Let them do as the railroads have done in establishing colonization bureaus. That Northwest community which has plenty of laborers will attract industrial concerns to locate therein. No matter how plentiful the raw materials, how cheap the transportation and power, or how ready the market, satisfactory labor conditions must first be secured. Any campaign to interest prospective industries should be predicated upon and preceded by a campaign of colonization. New publics must be made for everything, and the men who make them are world-beaters.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

P. D. Callahan, salesman, Fairies Manufacturing Company, Decatur, Ill., is at San Francisco.

G. M. Reading, manager Reading Transportation Company, Hudson, Nev., is at San Francisco.

W. H. McDonell, Sacramento, Cal., is now associated with the Electrical Supply Company of that city.

C. S. Redding, of Leeds & Northrup, Philadelphia, spent the week on a business visit to San Francisco.

F. J. Somers, of the Century Electric Company, San Jose, was a visitor to San Francisco during the week.

I. L. Adelberg, Century Electric Company, St. Louis, Mo., is in California visiting all central stations and dealers in electrical machinery.

Walter Kahns, representing the J. H. White Manufacturing Company, manufacturers of fixture parts, Brooklyn, N. Y., is at Los Angeles.

Thomas Stacey, superintendent Fairview Golden Boulder Mining Company, is at San Francisco purchasing machinery and electrical equipment.

Geo. A. Sherman, storage manager of the Western Electric Company, San Francisco, returned from a trip through the Pacific Northwest this week.

C. L. Young, assistant manager Woolsey-Lovelock Light & Power Company, Lovelock, Nevada, was at San Francisco on business during the past week.

Dr. George C. Pardee of the State of California Conservation Commission, spoke at Hanford on the evening of November 7th on the new water law.

F. H. Leggett, Pacific district manager of the Western Electric Company, San Francisco, spent the last week on a business trip to Portland and Seattle.

C. F. Hartung who until recently represented the Kellogg Switchboard & Supply Company at Los Angeles, is now representing the Monarch Electric Clock system in that city.

N. I. Garrison, auditor of the Western States Gas & Electric Company at Stockton, Cal., has been appointed auditor for the Fort Smith Light & Traction Company, Fort Smith, Ark.,

Lafayette Hanchett, president of the Power Springs Company, who is prominently connected with the National Copper Bank of Salt Lake City, recently returned from an inspection of the plant.

Walter E. Jones, lighting specialist, H. W Johns-Manville Company, Seattle, has been appointed manager of the electrical department there to succeed **Frank W. Loomis**, who was transferred to Milwaukee.

W. G. Arthur Reid, Bryan-Marsh Electric Works of General Electric Company, Detroit, passed through San Francisco last week en route to Hawaii. Together with Mrs. Reid, he is making a trip around the world and expects to be away six months.

Joseph S. Wells, general manager of the Utah Light & Railway Company, and **Will Browne**, auditor, have returned from the convention of the Electric Railway Association at Atlantic City. They report a most profitable and enjoyable convention and one of the largest in the history of the association.

W. C. Orem, president Salt Lake & Utah Interurban Railway Company, took a party of prominent citizens over the route of their new interurban line between Salt Lake City and Provo. Included in the party were **Thos. R. Cutler**, general manager Utah-Idaho Sugar Company; State Senator **W. N. Williams, George Rust, Lafayette Hanchett** and **Will G. Farrell**, secretary Commercial Club.

H. R. Tobey, president N. W. Halsey & Company, New York and San Francisco, was a visitor at San Francisco and as a guest of the Pacific Gas & Electric Company visited the company's hydroelectric construction work.

Professor Harris J. Ryan of Stanford University will lecture on "High Voltage Phenomena," at the next meeting of the Associated Electrical & Mechanical Engineers, University of California, at California Hall, on November 19th at 8 p. m. The public will be welcome to attend.

Charles N. Black, vice-president and general manager of the United Railroads of San Francisco, was elected president of the American Electric Railways Association at its convention held at Atlantic City. Mr. Black is also a director of the company, a director and vice-president of the Sierra & San Francisco Power Company, president of the Monterey & Pacific Grove Railway and of the Coast Valleys Gas & Electric Company.

A. Norman, formerly manager of the Freeport (Ill.) Railway & Light Company, has been appointed manager of the Eugene Division of the Oregon Power Company with headquarters at Eugene, Oregon, effective November 15th. In this capacity he succeeds **R. M. Jennings**, who becomes manager of the Oregon Power Company at Marshfield, Oregon. **D. C. Greene**, at present manager at Marshfield, will become manager of the Everett (Wash.) Gas Company, December 1st, vice **H. H. Stephens**, resigned.

OBITUARY.

James Pass, president of Pass & Seymour, Inc., died at his home, Syracuse, N. Y., on October 30. He was a comparatively young man, being under 60 years of age and his sudden death came as a surprise to all. In 1890 he founded the firm of Pass & Seymour, Inc., and was active in its management and affairs; was also general manager of the Onondaga Pottery Company at Syracuse and a director of the First National Bank of Syracuse, N. Y.

MEETING NOTICES.

Oregon Society of Engineers.

The next meeting of the Society will be devoted to a discussion of courses of study most suited to develop the boys of the state into competent engineers. The meeting will be held in Room "A" in the new library building at Tenth and Yamhill, Thursday, November 13, at 8 p. m. The discussion is to be open to all who wish to express their ideas upon engineering education. Written discussion is desired.

Portland A. I. E. E. and N. E. L. A.

The November joint meeting of these associations was held Tuesday, November 4, at 8 p. m. in the Portland Railway, Light & Power Company's assembly room, First and Alder streets, when Mr. B. C. Condit, chief engineer Northwestern Electric Company, presented an interesting paper on the plant of the Northwestern Electric Company at Portland.

Electrical Supply Jobbers' Association.

The next meeting of the association will he held at Del Monte on Thursday, Friday and Saturday, December 4, 5 and 6. It is expected that this meeting will prove one of the most successful yet held. The secretary, Albert H. Elliot, reminds the members that it is necessary to notify him of their intention to attend this convention that adequate arrangements may be made early.

Portland Association, A. S. C. E.

E. G. Hopson, supervising engineer U. S. Reclamation Service, is president of the association, and Chas. J. McGonigle, consulting engineer, secretary. This association held its first meeting during the latter part of October at

the Portland Commercial Club. There will be three other meetings during the season.

Robert G. Deick, commissioner of public works, Portland, Ore., gave an address on the "Inefficiency of the Bancroft Bonding Law," and offered a substitute which it was claimed would save the city a considerable sum of money and be more fair to the various contractors. The Bancroft Bonding Law allows property owners five or ten years in which to pay for municipal improvements such as sewers, pavements, etc., although during that period they are required to pay interest on the deferred payments.

Utah Electric Club.

At the regular luncheon of the Utah Electric Club Thursday, October 30th, Mr. T. W. Boyer, Cashier of the Continental National Bank of Salt Lake City, and President of the Clearing House Association, spoke on the subject, "Pending Currency and Banking Legislation." Mr. Boyer was a special delegate to the Chicago convention of bankers. He has made a careful study of the bill and presented the view points of those bankers who object to the regional reserve banks and other features of the bill. It is quite likely that in order to hear both sides of the subject a supporter of the administration measure will be invited to discuss it at a luncheon of the club in the near future.

San Francisco Electrical Development and Jovian League.

Tuesday's meeting was an "enthusiastic get-together" gathering given over entirely to the transaction of Jovian Order business. The new Statesman for northern California, A. E. Rowe, presided, being assisted by retiring Statesman A. H. Halloran, who told of doings at the national convention at New York in October. The members of the degree team for the ensuing term were announced as follows: Jupiter, A. E. Drendell; Neptune, Walter Seaver; Pluto, W. L. Scobey; Vulcan, A. V. Thompson; Avrenim, Geo. Gray; Hercules; J. R. Cole; Mars, Albert Elliot; Apollo, C. F. Butte; Mercury, W. W. Hanscom; Imps, I. L. Capps, J. A. Herr, W. L. Neelands, Miles Steel, W. J. Tardiff, W. R. Dunbar. Fred H. Poss was selected by the new Statesman to act as alternate Statesman and to serve as chairman of the entertainment committee, which is to arrange for the program on Jovian days—the first Tuesday of each month. As chairman of the membership committee, Mr. G. I. Kinney was appointed, the additional members of the committee to be selected by the chairman.

Notice of a rejuvenation to be held January 10, 1914, at San Francisco was given.

TRADE NOTES.

The Kellogg Switchboard & Supply Company has opened offices in the Fernando Building, Los Angeles. L. H. Balwin is representing the company.

The McDonnell Electric Works, Sacramento, Cal., has been absorbed by the Electrical Supply Company of that city and stock and furniture are being transferred. Mr. McDonnell will take active part in outside work, both in the city and country.

NePage, McKenny & Company, electrical engineers and contractors, with offices in Spokane, Seattle, Portland, Vancouver, B. C., and Victoria, B. C., have been awarded the complete electrical installation in the new union passenger depot being constructed in Spokane by the Oregon & Washington Railway & Navigation Company. The contract amounts to approximately $7000. This depot is to be one of the finest passenger stations in the northwest, and is to be equipped with all the latest electrical innovations in the way of lighting and power. Plans are drawn up by the railway company's engineer.

At Los Angeles it was desired to electroplate some steel bars about 2 in. in diameter and 16 to 18 ft. long. A special plating tank was built but it was found that as the work had to be at a place some distance away from the regular plating dynamo, it would be almost prohibitive to carry the necessary large wires over to the special plating tank. It was finally decided to borrow 24 cells of A-8 300 amp. hr. Edison storage battery, connect these in multiple series of 3 cells each, this being done by drilling holes in a copper bar and fastening all positive terminals of each set to one buss bar and all negative terminals to the other. This made a battery of 2400 amp. hr. capacity of 3½ to 4 volts, and the special job of plating was done with entire astisfaction, practically no expense for special wiring and very little trouble in placing the battery as the Standard car lighting set of 25 cells of A-8 Edison battery weighs but 890 pounds

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NEW CATALOGUES.

The quarterly calendar issued by the Crocker-Wheeler Company, Ampere, N. J., is also a convenient Speed and Frequency Table for a.c. apparatus.

The Ohio Brass Company's Bulletin for October contains considerable information regarding electric railway, transmission and mine haulage materials.

The Eichcff take-up and pay-out reels for electric light, telephone and telegraph line work is described in a pamphlet recently issued by Mathias Klein & Sons, Chicago, Ill.

A new attacment plug, Catalogue No. 785 and 786, manufactured by the Trumbull Electric & Manufacturing Company, Plainville, Conn., is featured in the latest bulletin issued by that company.

An issue of "Reactions," a quarterly published by Goldschmidt Thermit Company, contains much valuable information regarding the Thermit process of welding. New pamphlets on rail welding, pipe welding and the Goldschmidt Thermit Rail Grinder have also been published and are ready for distribution.

Bulletin No. 36 now being distributed by the Sangamo Electric Company, Springfield, Ill., deals with Sangamo Ampere Hour meters for general service. The special features and constructional details are carefully explained as are also the many uses to which this complete line may be put. A price list is included and discounts may be obtained upon application to the company.

A tastefully and artistically gotten up brochure produced by Ray D. Lillibridge, Inc., Technical Advertisers, New York City, is now being mailed. It is entitled Pioneers, and deals with pioneers in the field of electrical endeavor. The brochure is well worth sending after. Published by tne Wagner Electric Manufacturing Company, it directs attention to some of the results of the pioneer work of that company also.

Bulletin No. 710-11 has been published by the Standard Underground Cable Company, Pittsburg, Pa., dealing with Davis Station (D. S.) cable terminals, designed for indoor use or for locations sheltered from direct rain. Outdoor service terminals manufactured by the same company are dealt with in Bulletin No. 700-1. The Bulletins contain full information regarding types, tests, constructional details and dimensions.

Issue No. 17 of small motors, a magazine published monthly by the industrial and power department of the Westinghouse Electric & Manufacturing Company is devoted to electric vehicles. Characteristic curves of vehicle motors are given as well as halftone views and cross sections of the different motors. Westinghouse a.c. watthour meters are fully described and illustrated in folder 4241. Lead curves of different types of meters are also shown. "Motor Driven Dairy, Creamery and Ice Cream Machinery" is the title of a pamphlet (Section 3195). Folder 4266, entitled "The Electric Breakfast Set," describes and illustrates Westinghouse toaster stove and coffee pot type percolator, and shows how easily a breakfast can be prepared by those convenient devices.

INDUSTRIAL

UNIQUE LIGHTING GLASSWARE.

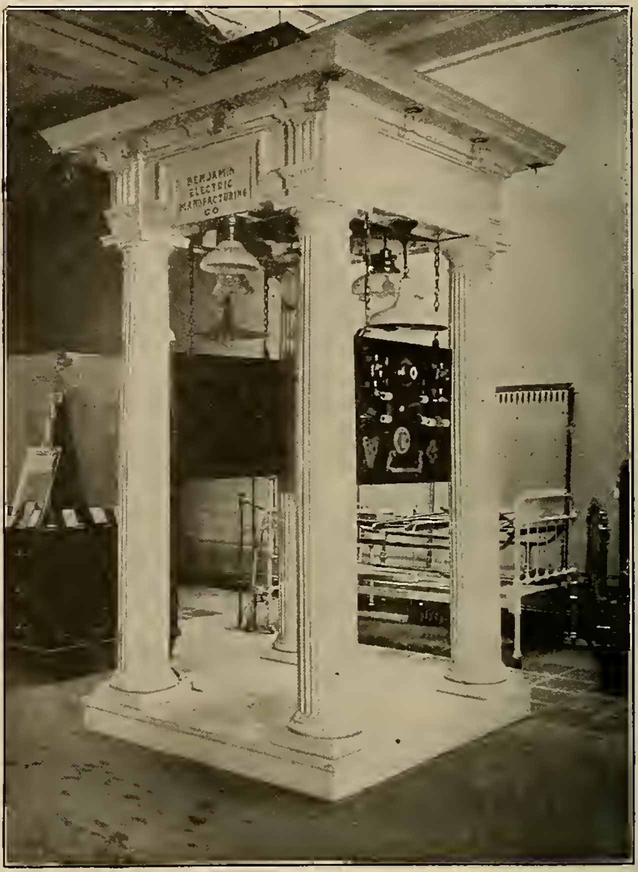
An interesting development in illuminating glassware has been placed on the market by the Holophane Works of General Electric Company and consists of a translucent wall plaque

Wall Plaque.

the design being a girl's head. This should find many novel uses such as the lighting of picture theater entrances by being worked into the design of the facade, and so on. It is fourteen and one-half inches high and ten and three-eighths inches wide.

BUENOS AIRES ELECTRICAL EXHIBIT.

The illustration shown below gives a fair idea of the excellent showing made by the Benjamin Electric Manufacturing Company at an industrial exhibition held recently at Buenos Aires. Sample boards contained the smaller units and specialties and the reflector sockets and pendant fix-



Benjamin Electric Manufacturing Company's Exhibit.

tures were suspended from the ceiling of the booth. The company's trade in South America has increased very appreciably during the past year and with a further improved market and with persistent advertising presenting this line to the trade, a still greater increase should result from now on.

MINIATURE ELECTRIC WINDOW DISPLAY SIGNS.

Perhaps one of the most perplexing problems the retail merchant has had to deal with is a method by which his display windows might be made to appeal to the night shopper. Too often on account of the want of a medium that would appeal to the people on the street has the store been closed up for the night and the windows left in total darkness.

With the aid of the new window display signs this want is entirely overcome. Individual electric sockets, so made that they can be connected up in series, carry a small incandescent lamp and reflector. The letters of the alphabet are made of transparent glass with opaque borders, each letter plate being about 4x5 inches, and with the opaque borders stand out clear and distinct. Each reflector is equipped with grooves, into which a letter may be slipped, and by connecting together a sufficient number of these interchangeable sockets and insertion of the letter plates in their proper order, a word or sentence of any length may be made up by the window-dresser.

Demonstrations and exhibitions of this unique window invention are in progress at the Pacific States Electric Company, 575 Mission street, San Francisco.

WAGNER SINGLE-PHASE CONVERTER.

The Wagner Electric Manufacturing Company have placed on the market a new single-phase converter described in their Bulletin No. 103. The single-phase converter is useful for any purpose demanding direct current when only alternating current is available. For electric vehicle battery charging the control of the converter is effected by a specially designed switchboard panel which may be supplied with relays and instruments for controlling the battery charge and cutting off the current when the battery is fully charged. The converter has also found an extensive application in moving picture theaters for supplying direct current for the projection arc lamps. On account of its simplicity of starting and its synchronous running, it is being applied to X-Ray apparatus for operating the synchronous interrupter.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—The incorporation of the Wright-Howard Electric Company is announced, the capital stock being $10,000; G. C. Wright, W. F. Howard, W. Smith are the incorporators.

PHOENIX, ARIZ.—The Rapid Transit Company has been incorporated with a capital stock of $1,000,000, by J. J. Corrigan, R. A. Campbell, C. Brady, T. H. Adams and W. S. Bradford of Phoenix.

ILLUMINATION.

MORTON, WASH.—The city council has granted F. H. Broadbent a franchise to operate an electric lighting and power plant in this city for a period of 49 years.

RICHMOND BEACH, WASH.—The application of the Edmonds Electric Light & Power Company for an electric franchise in Richhmond Beach and vicinity has been granted.

NATIONAL CITY, CAL.—Sealed bids will be received up to November 18th for lighting streets, avenues and parks of National City for a period of 5 years, beginning December 16, 1913.

PHOENIX, ARIZ.—The city council has decided to call a new bond election for November 26th. Items on which voters will ballot include $50,000 for extension of the street lighting system.

LOS ANGELES, CAL.—Sealed bids will be received up to November 17th, by the board of supervisors of Los Angeles county for installing and maintaining a system of street lighting in Moneta lighting district.

COMPTON, CAL.—The Pacific Light & Power Company has been granted a franchise to construct and maintain for a period of 50 years, an electric pole and wire system along all streets and thoroughfares in this city.

SALINAS, CAL.—The Coast Valleys Gas & Electric Company has made application for authority to issue $114,000 additional first mortgage 6 per cent bonds, in order that it may expand its plant to care for the increasing needs of consumers in the neighborhood of Salinas.

SAN DIEGO, CAL.—The railroad commission has rendered a decision granting authority to the San Diego Consolidated Gas & Electric Company to issue $27,000 of bonds under previous authorization of commission. The bonds are to be used for additions and betterments to the company's plant.

VISALIA, CAL.—The Mt. Whitney Power & Electric Company has just completed the installation of an improved modern arc light system here which is a marked improvement over the old system. The new lights are 6.6 amp. luminous arc lamps. In some of the large cities of the state, the old enclosed carbon arcs have been replaced by the 4 amp. luminous arcs, as even the 4 amp. lamps give a better light than the old carbon arc lamps. The new 6.6 amp. lamps installed by the Mt. Whitney Company in Visalia, give from two and one-half to three times the light of the old arc lamps. The company is able to take this progressive step and install these new lights without increasing the rates. In this connection, the city has increased the number of lamps from 55 to 83, and can now share the claim of Porterville as being the best lighted city for its size in the state.

TRANSPORTATION.

TACOMA, WASH.—The Seattle, Tacoma & Olympia Railroad Company, a newly incorporated organization, has filed an application for a franchise in this city for an elevated electric railroad, the line to run over practically the same territory embraced in the plan of the local traction company.

SALT LAKE, UTAH.—Grading is practically complete on the new interurban line of the Salt Lake & Utah Interurban Railway Company between Salt Lake City and Provo and it is reported that track laying operations will commence at an early date.

RICHMOND, CAL.—Two carloads of anglebars used between rails and ties in track laying were unloaded last week by the Southern Pacific Company along its main line right of way at the Cutting boulevard crossing, to be used in the construction of the railroad's interurban electric extension into Richmond.

SAN FRANCISCO, CAL.—The Sacramento Valley Railway Company has applied to the commission for a modification of its previous order, in which the commission allows the company to expend $1000 per month in organization work. The company asks for authority to expend $1250 per month for that work.

CENTRALIA, WASH.—The Washington Electric Railway Company has applied for a franchise to construct and maintain electric or other power roads, other than steam, along certain streets and roads in Lewis county beginning at the intersection of Chehalis, Summa and Grand avenues. A hearing will be given by the county commissioners November 17th.

SAN FRANCISCO, CAL.—B. F. Legare, engineer of construction for the United Railroads, has applied to the board of works for a permit to open Fulton street between Forty-ninth avenue to the Great Highway so as to complete the Fulton street tracks, which now terminate at Forty-ninth avenue. The board has referred the petition to the city engineer for a report.

OAKLAND, CAL.—The Oakland, Antioch & Eastern Railway has put into operation its new automatic electric block-signal system between Oakland and Chipp's Island. Work is in progress upon the installation of the block signals between Chipp's Island and Sacramento. This installation will establish a national record as the first interurban traction company in America to install a complete safety system of this character.

SAN FRANCISCO, CAL.—The resolution levying assessment in the matter of the construction and completion of a tunnel with approaches and appurtenances thereto and of the acquisition of lands and easements therefor, under the Twin Peaks Ridge was finally passed by the supervisors. This action clears the way for commencing construction work on the $4,000,000 subway which is to give rapid transportation facilities to the section west of Twin Peaks.

TRANSMISSION.

VANCOUVER, B. C.—The Western Canada Power Company, is raising the height of its dams on the Stave River an extra 10 ft., so as to provide storage to permit the installation of two additional generating units of 10,000 kw. capacity.

SAN FRANCISCO, CAL.—It is expected that the new Spaulding-Drum plant of the Pacific Gas & Electric Company will be ready for operation by Thanksgiving, so that as soon as the water has risen in the lake electric energy will be sent along the high-tension wires from Drum to the bay.

SEATTLE, WASH.—Burning oil in a transformer at the substation of the municipal electric light plant, burned out the feed wires, extinguishing all the street lights in the city, as well as the lights in many homes and churches last Sunday. The lights were out several hours, and in several churches services were held by candle light. The damage to the substation is said to have been trivial.

EATONVILLE, WASH.—Bids will be received at the office of Chas. C. Biggs, town clerk, up to November 14th, for the construction of a transmission line to La Grande, Wash., and distribution system in and for the town of Eatonville. Plans and specifications are on file and provisions of contract will be furnished by the Light and Water Department, city of Tacoma.

SALT LAKE, UTAH.—It is understood that the Power Springs Company has plans under consideration for increasing the capacity of its plant from 3000 to 10,000 h.p. The company is now selling most of its output to the Great Shoshone and Twin Falls Power Company. The rapid development of southern Idaho along electric lines would probably supply a market in the near future for the entire Thousand Springs development.

SAN DIEGO, CAL.—Announcement has been made of the construction within a short time of a cotton mill to cost $300,000 to utilize the cotton grown in the Imperial Valley. Within a short time 130,000 additional acres of new land will be opened for settlement in this valley, by means of the San Diego & Arizona Railroad now under construction. The railroad, which is controlled by the Spreckels interests, will run eastward from San Diego to Yuma, Ariz., connecting at the latter point with the Southern Pacific Railway. Application has just been made to the California Railroad Commission for permission to issue $15,000,000 bonds to complete the line. Forty miles have already been constructed and contracts have been let for all but ten miles of the road. Completion is promised within two years.

BOISE, IDAHO.—The Beaver River Power Company, which entered the local electrical field in opposition to the Idaho-Oregon Light & Power Company, has just sold out to the Idaho Railway, Light & Power Company, holding company of the Idaho Traction Company, which in turn controls the stock of the Idaho-Oregon Light & Power Company. The consideration was approximately $500,000. The deal is one of the largest in the power line that has taken place in this section for years, and gives the Idaho-Oregon Company complete control of western Idaho territory. The Beaver company recently changed its incorporation in western Idaho to the Idaho Power & Light Company. The deal only includes the Beaver River holdings in this section of Idaho. It was closed through S. L. Fuller, representative of Kissel, Kinnicutt & Company, who financed the Idaho Railway Company.

SEATTLE, WASH.—The secretary of agriculture has granted to the Skagit Power Company a permit for the development of two water power sites on the Skagit and Cascade Rivers in Skagit county, Washington, within the Washington national forest. It is stated by officials of the company that construction work on the Skagit project will be commenced within a comparatively short time. The construction will consist of a concrete diverting dam, 50 ft. in height, a tunnel conduit about 3.7 miles in length, and a power house on the Skagit River about 125 miles from Seattle, at which most of the power output will be marketed. In developing power from the Cascade River, the flow will be diverted by a concrete dam having a height of 20 ft. and a maximum length of about 200 ft. A flume and tunnel will carry the water a distance of approximately six miles to the proposed power house. Machinery capable of generating over 50,000 h.p. will be installed at the two power houses, according to the estimates of the engineers.

TELEPHONE AND TELEGRAPH.

OXNARD, CAL.—The Limoneira Company has been awarded a contract for the construction of 16 miles of private telephone line on ranch property.

SANGER, CAL.—The commission has granted authority to the Sanger Telephone Company to sell its property in Fresno county to Ross B. Matkins for $10,000.

MONTEREY, CAL.—The commission has granted authority to the Pacific Telephone & Telegraph Company to consolidate its telephone exchanges at Pacific Grove and Monterey.

CLIFTON, ARIZ.—The property and franchise of the Duncan Telephone Company have been sold by the sheriff under attachment, and may be merged with the Mountain States system.

SAN DIEGO, CAL.—The commission has granted authority to the San Diego Home Telephone Company to issue $150,000 in promissory notes maturing serially during a period of five years. The money is to be used to refund existing indebtedness, and to make extensions of the company's system. The company will pledge its bonds as security for the notes.

SAN FRANCISCO, CAL.—The railroad commission has granted authority to the Pacific Telephone & Telegraph Company to issue $3,000,000 bonds. The proceeds are to be used to retire underlying bonds of the Sunset Telephone & Telegraph Company and the balance is to be spent largely for improvements in the company's system in San Francisco, the San Francisco Bay territory, Los Angeles and other parts of the state.

SAN FRANCISCO, CAL.—The board of works has given the Pacific Telephone & Telegraph Company a permit to lay underground conduits in Polk street to Chestnut from its manhole at Broadway and in Chestnut street to Van Ness avenue. Thirty-five poles will be taken down. The company's conduits will be carried as far as the Exposition gates, and the city engineer says that this work will clear up the crossing at Van Ness avenue and Chestnut street so as to eliminate interference with the city railway which is to be built.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company and ten of its stockholders have filed a petition with the railroad commission, asking for a rehearing in the San Jose rate case, which was decided against the telephone company a week or two ago. The company states that the commission erred in certain calculations and that its figures do not take into consideration the actual value of the company's properties, its earnings and expenditures in the San Jose territory. In its decision the commission, referring to the contract under which the Pacific Telephone & Telegraph Company pays 4½ per cent of its gross receipts to the American Telephone & Telegraph Company, found this sum excessive and referred to it as a device to deflect earnings. In their application for a rehearing the stockholders of the Pacific company state that if the commission does not allow the company to make these annual payments the funds necessary must be taken from earnings which would otherwise be distributed to them.

WATERWORKS.

MANHATTAN BEACH, CAL.—A bond election has been called for November 22d, to vote bonds in the sum of $110,000 for a municipal water system.

MONTAGUE, CAL.—With a big interest shown here in the election to issue bonds for water works in the sum of of $25,000 the proposition carried by a vote of approximately eight to one.

OROVILLE, CAL.—The South Feather Land & Water Company, which operates above Oroville at Wyandotte, Bangor and Forbestown will begin soon the installation of 1565 ft. of 22 in. redwood syphon on the Wyandotte ditch near Forbestown.

CENTRALIA, WASH.—The city commission has announced the closing of a deal with the Weyerhouser Timber Company for an intake site and right-of-way for the proposed municipal water system, to be built from the headwaters of the north fork of the Newaukum River.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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ELECTRICITY IN THE UNION IRON WORKS.

BY R. H. FENKHAUSEN.

STRAIGHT LINE DIAGRAM.

BY J. P. ZIPF.

FACTORY LIGHTING AND WORKMEN'S COMPENSATION.

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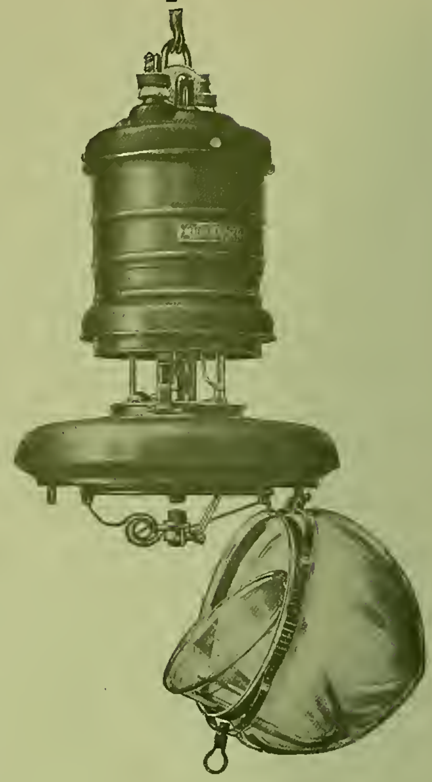

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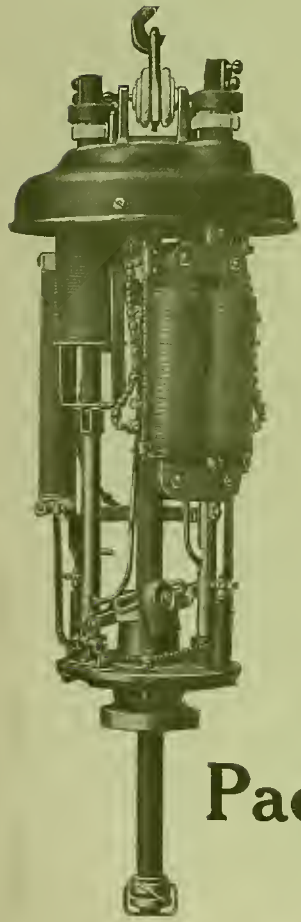

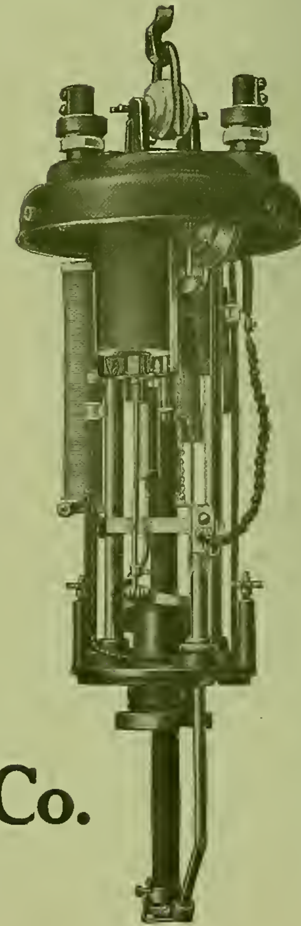

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ELECTRICITY IN THE UNION IRON WORKS

BY R. H. FENKHAUSEN.

Union Iron Works, San Francisco.

During the early part of the year 1911 the management of the Union Iron Works Company, San Francisco, commenced work on a comprehensive plan of improvements, which when completed will have accomplished the reconstruction of practically the entire plant.

One of the first problems encountered was the rehabilitation of the power plant, which had become inadequate to the rapidly increasing power demands of the various departments. A description of the old power plant will be found in the June, 1901, issue of this journal and it will be noted that practically all machine tools were at that time operated from line shafts driven by electric motors.

Before starting work on the new plant the heavily overloaded equipment in the old was first relieved by the elimination of all possible line shafts and the installation of individual motors on each machine tool. Several hundred horsepower were eliminated in this way because in most cases the shafting was old and badly out of line.

In laying out the new power system the advantages of the Diesel engine and the steam turbine were carefully balanced against those of purchased power, but the poor load factor incidental to the operation of the plant for only eight hours out of the twenty-four made the fixed charges on the plant too high to successfully compete with the rates which the power

companies were able to offer for power used off peak.

Although several power companies offered favorable rates the contract was awarded to the Pacific Gas & Electric Company. Continuity of service was paramount and it was felt that the company's big station at Humboldt and Georgia streets offered maximum security against interruptions.

Up to this time all electric power had been furnished 220 volt d.c., but as soon as the power contract was signed arrangements were made to use alternating current in all new shops in order to save transformation losses.

Several new shops then near completion were equipped with a.c. motors and the 440 volt, 3 phase system, was selected for distribution. As the new power house had not yet been started a temporary 2400 volt, 2-phase, feeder was run into the plant and a 400 k.v.a. bank of transformers (Scott connected) installed to carry the load.

A 75 kw., 220 v., d.c. generator belted to a 2400 v., 2 phase induction motor installed several years before to carry the night load was also pressed into regular service, to assist the old d.c. plant on the peak. After having thus temporarily provided for the immediate growth of the plant work was started in earnest on the new power system.

New Power House Building.

The power house building is situated at the intersection of 20th and Michigan streets and architecturally is one of the ornaments of the Potrero district. It is built of reinforced concrete, the architecture being Spanish Renaissance and the roof tiled in Mission style. The building is 126 by 40 ft. and is two stories in height, but owing to the rise in grade of 20th street the second or main floor is on the street level. Fifteen feet has been left between the building and the sidewalk, and this space together with the entire surrounding area is covered with well-kept lawns and flowers.

A ten-ton traveling crane spans the entire operating floor, which at night is illuminated by flaming arc lamps.

The lower floor is on the level of the works and is used by the electrical department as a repair shop and storeroom, with the exception of the east end where the high tension bus structure and switch compartments are located.

In addition to the step down transformers and distributing switchboard the station contains rotary converters for carrying the direct current load and air compressors for the operation of the many pneumatic tools in use throughout the plant.

Kinds of Power Furnished.

The construction and repair of ships which is one of the most important branches of the company's activities, is a complex business and the diversified processes involved require many different kinds of power, a few of which are given below:

Compressed air at 100 lb. per sq. in. for pneumatic tools, etc.
Low pressure air at 10 to 32 oz. for forges, oil burners, etc.
Hydraulic at 1700 lb. per sq. in. for presses, lifts, etc.
Salt Water at 60 lb. per sq. in. for sprinkling, etc.
Salt water at 120 lb. per sq. in. for fire protection.
70 v., d.c. for electric welding.
125 v., d.c. for excitation and battery charging.
230 v., d.c. for general d.c. power purposes.
330 v., d.c. for submarine boat charging.
70 v., 3-phase, 60-cycle, a.c., for starting rotary converters.
140 v., 3-phase, 60-cycle, a.c., for running rotary converters.
208 v., 3-phase, 60-cycle, a.c., for distributing 120 volt lighting.
240 v., 3-phase, 60-cycle, a.c., for starting air compressors.
480 v., 3-phase, 60-cycle, a.c., for general a.c. power.
120 v., 1-phase, 60-cycle, a.c., for ship and plant lighting.

Each type of service will be taken up in detail later on in this article.

Eleven k.v. Cables and Switches.

Three-phase, 60-cycle current is furnished at 11,000 volts over duplicate underground cables following different routes and each tied in to a different station of the supply company. These cables run directly to the concrete bus structure on the lower floor of the power house where the necessary disconnecting and oil switches are installed. The oil switches are operated by remote mechanical control from the station panel on the main switchboard.

Disconnecting switches are provided which permit any or all poles of any oil switch to be short-circuited and then isolated so that work can be performed on the 11 k.v. switches without danger and without interruption to the service. All switch and bus compartments are provided with wire plate glass doors permitting inspection of the entire installation at all times.

Transformers.

The transformer installation consists of:

Three 500 k.v.a., 11000/480 v., shell type, self-cooled, transformers, delta-connected for general a.c. power distribution, and provided with half taps to furnish 240 v. starting current for the air compressor motors.

Three 50 k.v.a., 11000/120 v., core type, self-cooled, transformers, star-connected with grounded neutral for general lighting distribution.

Two 225 k.v.a., 11000/140 v., 3-phase, core type, self-cooled transformers for the rotary converters and provided with half taps to furnish 70 v. starting current.

Switchboard.

The main switchboard is composed of 18 vertical panels of natural black Monson slate 90 in. high. Its total length is 34 ft., which, with the three ft. ornamental grill work gate on each end occupies the entire width of the building.

From left to right the service of the various panels is as follows:

1—28 in. a.c. feeder panel; 2—600 amp, 480 v., feeders.
2—28 in. a.c. feeder panels; 2—400 amp., 480 v., feeders.
4—28 in. a.c. 450 h p., 480 v.. synchronous motor panels.
1—32 in. a.c. 11000 v., station panel.
1—16 in. d.c. exciter panel, 500 amp., 125 v.
1—28 in. a.c. lighting panel; 2—60 amp.. 208 v., feeders.
2—20 in. a.c. rotary converter panels, 1200 amp., 140 v.
2—16 in. d.c. rotary converter panels, 1200 amp., 230 v.
4—16 in. d.c. feeder panels, 600 amp., 230 v.

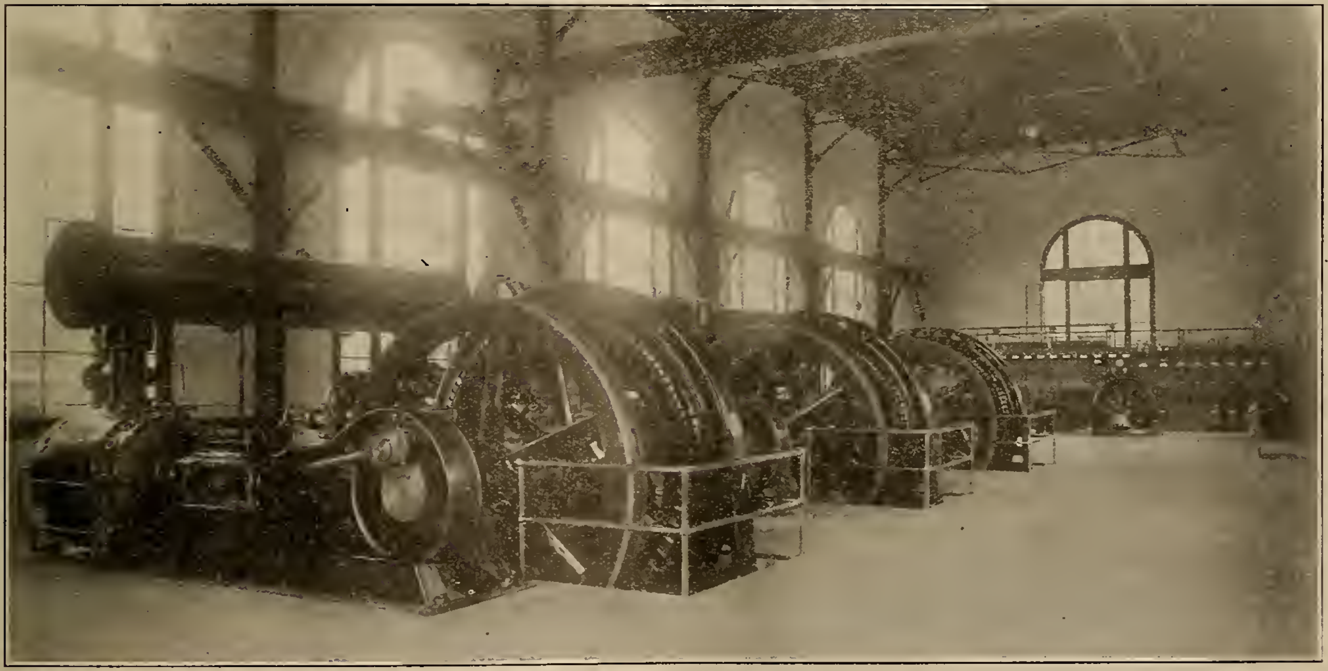
All machine and feeder circuits are provided with watt-hour meters in order that each department may be charged with the proper proportion of the power house cost. All a.c. feeder circuits are protected by time limit overload relays, and three-way ammeter switches enable any unbalance on the system to be readily detected.

Bus Bars and Cable Work.

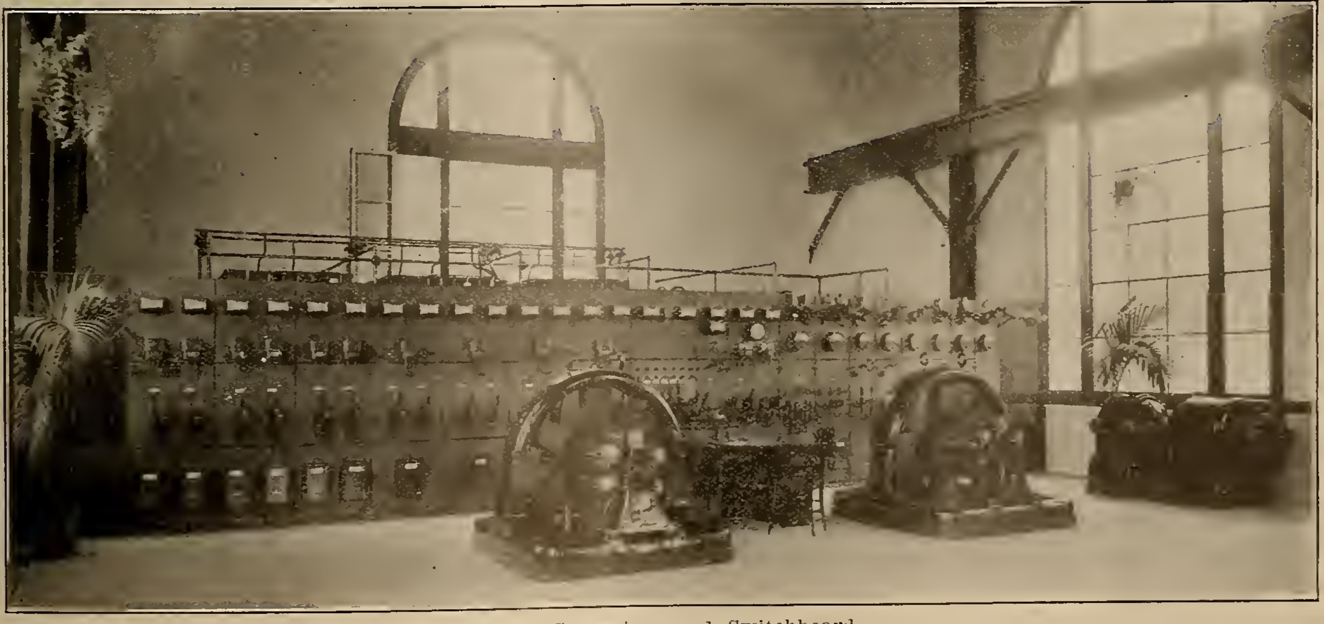
All connections between the low tension side of the transformers and the bus bars have been made with rectangular bare copper bar polished and lacquered and cable has been eliminated wherever the use of bar copper would improve the appearance of the installation.

The cables between machines and switchboard are varnished cambric insulated, asbestos covered, station

Exterior of New Power Plant.



Interior of New Power Plant.



Rotary Converters and Switchboard.

cables carried on racks to the machine foundations and thence in fibre conduit to the terminals. Single conductor cable was used exclusively for this work owing to the difficulty of finding space for multi-conductor cables in the floor slabs.

All out-going feeder cables both a.c. and d.c. are paper-insulated, lead covered, and will be described in connection with the distribution system.

Compressed Air Service.

The heaviest load on the power plant is the compressed air service at 100 lb. per sq. in. from which operates all the air drills, chipping and caulking hammers, etc., used in boilermaking and shipbuilding.

Compressed air is also used for innumerable other purposes, such as blowing out motors and machinery and operating small steam engines and hoists on ships laid up for repairs.

The air compressors are of the Franklin type manufactured by the Chicago Pneumatic Tool Company and are two-stage machines 28 in. and 17 in. dia. by 26 in. stroke, each having a capacity of 2500 cu. ft. of free air per minute. Three of these machines are at present installed but foundations, wiring and switchboard equipment for a fourth are already in place.

The air intake valves are of the positively operated Corliss type and the discharge valves are of the poppet type. An inter-cooler reduces the temperature of the air after its discharge from the initial stage. Salt water is used in the water jacket and intercooler circulating system and has caused no trouble so far due to the rapid circulation kept up in the entire system to prevent the deposit of seaweed, etc.

A forced feed lubrication system is used for the cylinders and Corliss valves but the rest of the machine is oiled by multiple sight feed oilers piped to all parts of the compressors.

On the main shaft of each compressor is mounted the revolving field of a General Electric three-phase, sixty cycle, 480 v., 138½ r.p.m., synchronous motor rated 450 h.p. at unity power factor. Amortisseur windings are installed on the revolving field and the motors are started up by the application of half voltage to the stator windings. The motors accelerate quite rapidly as an atmospheric relief valve on the compressor is left open when starting up. After starting current has fallen to about 600 amp. per phase, full voltage is applied to the stator and the field switch closed. The atmospheric exhaust valve is then closed, placing the machine on the line. On several occasions during the operation of the plant all three compressors have been started and put on the line in less than two minutes.

The compressors being synchronously driven are necessarily constant speed machines and must therefore govern by unloading at a predetermined pressure. Several types of governors acting on both the intake and discharge sides of the compressors are now under test for efficiency but as yet no final choice has been made.

In order that constant pressure may be maintained at the center of air distribution a one-half inch pressure pipe has been carried back to the power house from the end of the main line, and the governors and pressure gauges are operated from this source. By this means the compressors are "overcompounded" (to use an electrical term) and line-drop compensated for as effectively as in a d.c. generator.

For use at night several small portable motor-driven compressors on trucks are in use which may be run to any department requiring compressed air to operate a few pneumatic tools after working hours. These sets average 200 cu. ft. capacity each and are driven by induction motors provided with flexible cables and plugs, which may be quickly inserted in connection boxes installed at convenient points throughout the works on the 480 volt a.c. system. A small receiver with several hose connections is suspended between the wheels of the sets and by connecting direct to these the air leakage due to keeping the entire air distribution system under pressure all night is avoided.

Excitation System.

Excitation for the synchronous compressor motors is furnished by a three-bearing motor generator set consisting of a 440 volt, 1200 r.p.m., induction motor direct connected to a 50 kw., 125 volt, compound-wound, d.c., inter-pole generator. This set is started from the half-voltage bus bars, no compensator being required, and is large enough to take care of all future additions to the compressor plant as well as the charging of storage battery trucks and the supply of 110 volt, direct current to the repair shop for the testing of the numerous 110 volt d.c. motors sent to the shop from ships under repair at the works.

Rotary Converters.

Direct current for general power distribution at 230 volts is furnished by two 3-phase, 60 cycle, 1200 r.p.m., shunt-wound, rotary converters rated 200 kw. at unity power factor, and operated in parallel on the direct current end.

Amortisseur windings are installed in the pole faces to prevent hunting and permit starting as induction motors by the application of half-voltage to the collector rings. When the rotary locks in step if correct polarity is indicated by the direct current voltmeter the field break-up and reversing switch is closed in the upper position and full a. c. voltage applied to the machine, after which it is thrown on the d. c. bus.

Mechanical oscillators fitted to the armature shafts insure proper end play and over-speed governors arranged to trip out the d.c. circuit breaker upon fifteen per cent increase in speed prevent motor racing in the event of interruption of the a.c. supply.

Auxiliary Motor Generator Set.

A 4-bearing motor generator set consisting of a 75 h.p., 440 v., 900 r.p.m. induction motor flexibly coupled to a 50 kw., 250 v., d.c. generator is installed on the lower floor together with its own switchboard and is intended to carry small direct current loads at night as well as to help out in the event of damage to one of the rotaries.

An interesting feature of this set is the use of a pole-changing switch by which the a.c. motor may be operated at half speed and 125 volts direct current obtained by paralleling the shunt fields of the d.c. generator. This gives a spare source of excitation in the event of any accident to the exciter.

A.C. Motor Driven Cold Saws and Angle Iron Drill.

Electric Distribution System.

The electric distribution system is entirely underground and contains 7913 duct feet of three duct vitrified tile conduit connected by concrete manholes. There are three main duct lines of twelve ducts each leaving the power house and running north, south and east respectively and each terminating in a five by five manhole from which 3 in. Orangburg fibre conduit runs to the sub-distribution boards in the building.

No. 4/0 stranded lead-covered, paper-insulated cable for 1000 volt working pressure is used on all feeders, two conductor being used on d.c. and three conductor on a.c. feeders. Each feeder consists of at least two cables in multiple and porcelain pot heads with disconnecting links permit the isolation of any defective cable with only a momentary interruption to the service of the department affected.

The works are divided by 20th street into north and south districts and as far as possible this natural boundary line has been followed in the separation of the alternating and direct current distributions.

The south works consists mainly of machine shops and forms the direct current district while the north works is principally devoted to plate work and forms the alternating current district. There is however a certain amount of unavoidable overlap which is taken care of by one feeder running to each works and looped through all departments to provide for portable tools, etc.

There are twelve main feeders leaving the power house consisting of four direct current and six alternating current powers feeders and two alternating current lighting feeders, all of which are from 400 to 600 amp. capacity.

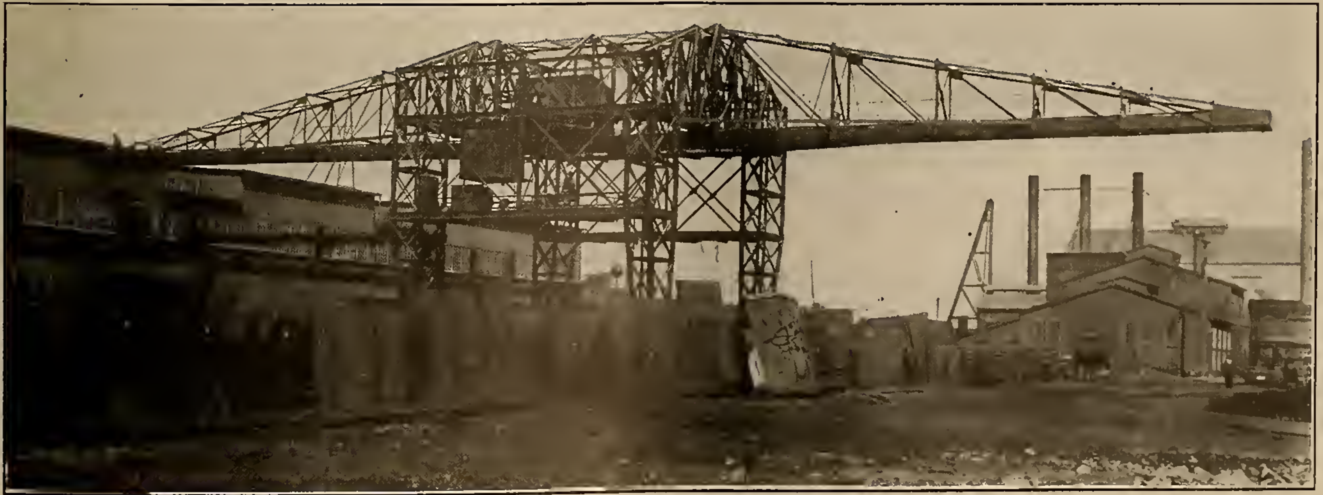
Each of the large departments is fed from an individual feeder metered at the main switchboard, but the small departments utilizing only a few motors are grouped to give a feeder of reasonable capacity. Each small department is connected to its feeder by a double pole contactor operated by push buttons in the power house enabling the load to be governed with great flexibility.

Sub Distribution Boards.

All underground cables terminate in six distribution boards installed just inside the building adjacent to each manhole and from which the various shop feeders run. Each feeder is limited to 200 amp. and fused with a 200 amp. code fuse. The sub-distribution boards are installed in sheet steel cabinets with glass doors and all those on the direct current system are provided with a totalizing ammeter and ground detector lamps.

Submarine Battery Charging Plant.

In a small sheet iron building located at the submarine building slips there is installed a 165 kw., three-bearing, motor generator set, consisting of a 250 h.p., 440 v., 900 r.p.m., induction motor direct connected to a 165 kw., d.c., shunt-wound, inter-pole generator.



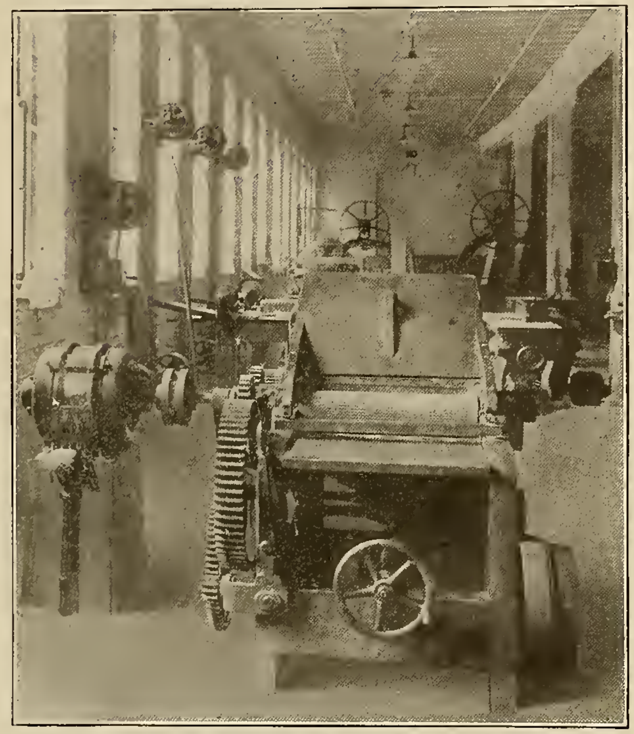
Three-Phase Cantilever Crane Over Stock Pile.

This set is used for charging the storage batteries on the submarine boats and is designed to supply a current of 300 amperes continuously at any voltage from 200 to 330 and to supply 600 amperes for a period of two hours.

The government specifications call for several test discharges of the batteries under various loads and these discharges are made by weakening the field of the d.c. generator thus driving the induction motor above synchronism and returning alternating current to the system.

Salt Water Pumping System.

Salt water at 60 lb. pressure for yard sprinkling, lavatories and general service is supplied by two motor-driven two-stage centrifugal pumps installed in a steel pump house on the wharf. These pumps also supply circulating water for the air compressor water jackets, etc., and in order to prevent possible interruption to this important service each pump is operated from a separate feeder. In case of fire the pumps may be operated in series, giving 120 lb. pressure.



Planer with Cutter Head Direct-Connected to 3600 r.p.m. Induction Motor.

1700 lb. Hydraulic Service.

Hydraulic at 1700 lb. pressure for the operation of bull riveters, keel benders, elevators, jib cranes, etc., is furnished by a triplex hydraulic plunger pump direct connected to a constant torque two speed induction motor rated 150 h.p. at 600 r.p.m. and 75 h.p. at 300 r.p.m. The low speed is used at night and during times of light demand on the hydraulic system, thus saving considerable wear and tear on the gearing, etc. Accumulators are installed at several points on the hydraulic system and help to steady the load and eliminate the too frequent operation of the automatic by-pass on the pump.

Low Pressure Air Service.

Low pressure air at from 10 oz. to 2 lb. per sq. in. is required for cupola blast, forges, etc., but owing to the heavy losses in transmission from a central plant individually driven electric blowers have been installed in each department requiring this service.

High Pressure Steam.

Two boilers furnish steam to the forge department hammers as well as for steaming tanks on fuel oil carrying steamers.

These boilers are equipped for oil burning but owing to the large amount of refuse from the various wood working shops shaving burning equipment is also installed.

Floating Dry Docks.

The two floating pontoon dry docks at the Potrero plant are now being converted to electric drive. Each dock is equipped with eight bucket pumps, the four on each pontoon being at present geared to a Corliss engine.

A 50 h.p., 440 v., 3-phase, variable speed motor, will be belted to the flywheel of each engine without in any way interfering with the operation of the docks by steam should it ever be necessary.

An underground 480 volt, 3-phase, feeder runs direct from the power house to the distribution panel between the two docks, from which point flexible cables are run to the pontoons permitting the necessary vertical movement of the docks.

Electric Welding.

In the repair of marine boilers and defective steel castings extensive use is made of the Slavanioff process of electric arc welding. Two electric welding plants are in use, one a portable motor generator set mounted on a truck for use ashore and the other a gasoline engine driven plant installed on a barge, which may be towed alongside any work afloat. A small air compressor is also installed on the barge to furnish air for chipping and caulking.

Ship Lighting System.

The choice of a distribution system for the supply of light and power to the various ships under repair at the plant presented quite a problem owing to the heavy load and the comparatively great distance from the substation.

A second transformation of power at the docks was for many reasons undesirable and owing to the temporary character of the wiring and the rough usage encountered it was not thought advisable to employ any system having a voltage strain to ground of over 120 volts.

The complication, weight and first cost of single-phase motors as well as the danger of gas explosions in oil tanks due to flashing at the centrifugal switching devices usually employed, made the use of polyphase motors almost imperative so that a 208/120 volt, 3-phase, 4-wire system with 208 volts between phases and 120 volts between phases and grounded neutral was adopted for this service.

Many portable motors are used to drive ventilating blowers, emery wheels, pipe cutters, cylinder boring bars, etc., and their operation from the lighting system enables both light and power to be carried aboard ship on one 4-conductor cable.

Although most ships are wired for 110 volts, quite a few foreign built vessels operate their lamps at 60, 80 or 90 volts and the use of alternating current enables

these voltages to be readily derived from the lighting system by means of auto transformers.

In order that the system may be kept balanced the phases are designated red, white and blue and all connections at the 50 different distribution points along the various wharves are plainly designated by colored bands.

The dock switchboard is equipped with ammeters and pilot lamps colored to correspond and a 200 amp. current transformer in the neutral operates a bell and signal lamp through a relay upon the occurrence of any unbalance in excess of the relay setting. When the neutral relay operates the attendant has only to glance at his ammeters and for example should he find the "red" high and the "white" low he merely transfers the nearest "red" ship to "white" to restore the balance.

Multiple 110 volt a.c. arcs are used for the general illumination of cargo holds, etc., supplemented by portable lamps in steam tight globes for each workman.

Induction Motor Driven Band Saw with Patented Starting Switch.

Plant Lighting System.

The various shops are lighted by a sort of three-wire system derived from two phases and the neutral of the ship lighting system. The shop lighting load is comparatively light and as most of the departments were already wired on the three-wire system the expense of adding the fourth wire was unwarranted as no power was desired on these circuits. The various three-wire circuits are balanced between phases at the power house distribution.

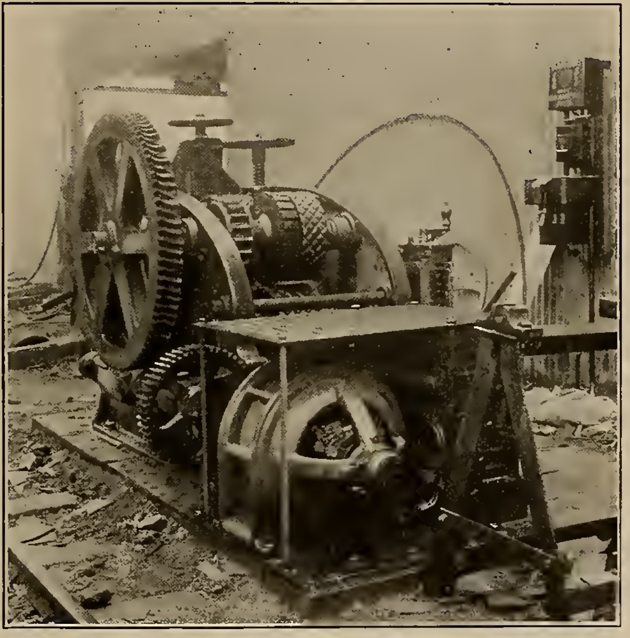
The general illumination of the plant is by 110 volt, 250 watt, Mazda lamps in enamelled steel reflectors except in a few of the larger buildings where long burning multiple a.c. flame arcs are on trial.

The use of local lighting is discouraged as far as possible by the provision of adequate general illumination, intensities as high as three foot-candles being obtained in certain departments, but a receptacle is installed on each machine tool to which a portable light may be connected for boring and other inside work.

All lighting is supplied at 110 volt a.c. except portable lights on machine tools where 230 volt d.c. is already run and where the duplication of circuits would be inadvisable on account of complication. Non-interchangeable plugs are standardized for 110 and 220 volt throughout the plant and the use of locking guards prevents interchange of lamps by unauthorized persons. In a very few locations in remote corners of the plant reached only by the 208/120 volt, 3 wire system, small amounts of power are furnished by 220 volt single-phase motors.

Direct Current District.

Direct current at 230 volts is used for power in all machine shops, the planing mill and the older traveling cranes throughout the plant. The superior speed control available with direct current motors renders them best suited for machine shop service and contrary to the usual opinion the repairs have been found to be no greater than on small induction motors.



Angle Iron Planer, Showing Construction for Variable Speed A.C. Motor.

About 500 d.c. motors are now in operation and when the work of changing the machine shops to individual drive is completed this number will probably not exceed 600 as all extensions other than machine shops are being made alternating current.

When shops are changed to alternating current the old d.c. motors are overhauled and used for extensions in the d.c. district, obviating the heavy loss of equipment usually caused by this change.

Carbon compression starting rheostats are in use on most of the motors but on all new work series contactor self-starters are being used and result in a great saving both in time and cartridge fuse renewals.

In order to show the great diversity factor incidental to the individual drive of machine tools data on a few d.c. feeders is given below:

No. 17—119 motors—1350 h.p.—600 kw. hr. per 8 hr. day.
No. 19—120 motors—1175 h.p.—750 kw.-hr. per 8 hr. day.
No. 21— 37 motors— 245 h.p.—400 kw.-hr. per 8 hr. day.
No. 23— 72 motors— 618 h.p.—425 kw.-hr. per 8 hr. day.

Feeder No. 21 is mainly composed of motors driving line shafts while the others are composed of individually driven tools exclusively and the difference in diversity factor is quite marked.

Alternating Current District.

Alternating current at 480 volt, 3-phase, is used in the boiler, forge, pattern and shipyard departments as well as in all pumping plants and the later traveling cranes. Individually driven tools are used without exception in the a.c. district, and although the introduction of alternating current into the plant occurred hardly two years ago the connected load already exceeds that on the d.c. system while the kilowatt hour consumption is three times as great.

Only about 125 a.c. motors are installed as yet but the number is rapidly increasing and the larger average size explains the high kilowatt hour consumption. Data on a few a.c. feeders is given below:

No. 1—65 motors—729 h.p.—450 kw. hr. per 8 hr. day.
No. 9—13 motors—112 h.p.— 50 kw. hr. per 8 hr. day.
No. 11—14 motors— 54 h.p.— 25 kw. hr. per 8 hr. day.

The department supplied by feeder No. 11 was formerly operated by a 25 h.p. motor driving a line shaft and the consumption averaged 150 kw. hr. per day, whereas now, with 14 motors totaling 54 h.p. the consumption is only 25 kw. hr. per day. This of course is an unusual showing but it illustrates only one of the many advantages of individual drive, among which are better light due to the absence of overhead gear and the ability to locate tools to best advantage without regard to the position of shafting.

A.C. Controlling Devices.

Squirrel cage motors of 5 h.p. and under are started by a double throw interlocking switch protected by both starting and running fuses. This switch was specially designed for iron works use and is patented and manufactured by the Union Iron Works Company.

Squirrel cage motors of 7½ h.p. and over are equipped with standard two-point starting compensators with cartridge fuses for starting protection and overload relays acting on the no voltage release for running protection.

Wound rotor variable speed motors of all sizes are equipped with reversing controllers and iron grid resistance and are protected by oil switches with both overload and no voltage release in addition to cartridge fuses.

Inspection and Maintenance.

A very complete system of records of all motor trouble coupled with systematic and regular inspection have reduced the maintenance cost to a very small figure and once the reconstruction of the plant is complete and temporary work eliminated the delays due to motor trouble will be negligible.

All electrical trouble is reported to the trouble operator who sends out the repair men, issues spare parts and keeps in touch with the entire power system.

All motors brought to the shop for repairs are completely overhauled, both electrically and mechanically, before being returned to service, and the series of tests given is so rigid that a motor rarely returns for repairs after passing the tester.

Rear View of Power House.

Acknowledgment.

The publication of this article was made possible through the courtesy of Mr. John A. McGregor, president Union Iron Works Co.

POWER PLANTS OPERATING ON NATIONAL FOREST RESERVES.

The records of the district office of the forest service in Odgen show that thirty-three hydroelectric power plants are operating in district No. 4 on national forest land, some under permit and some in alleged trespass now involved in litigation pending in the Circuit Court of Appeals. District No. 4 comprises the State of Idaho south of the Salmon River, all of the States of Nevada and Utah, Arizona, north of the Grand Canyon of the Colorado, and Southwestern Wyoming. These power plants have an installed capacity of 28,600 h.p.

The total number of power plants in the district, including those on private land, as well as those on the national forests, is approximately 100, having an installed capacity of 176,000 h.p.

Permits to occupy national forest land for the purpose of constructing, maintaining and operating water power projects within this district are handled by the district office of Ogden. Two distinct kinds of permits are issued. A preliminary permit will allow the occupancy of forest land usually for a period of from one to two years, for the purpose of securing data and estimates of the proposed project, and for such construction as may be necessary to preserve water appropriations within that period. A final permit allows the complete construction, maintenance and operation of the project usually for a period of fifty years, and is issued upon the receipt of the data secured by the applicant during the period of the preliminary permit.

No rental charges for the use of national forest land is made for water power projects of a capacity of 100 h.p. or less; for projects of municipal corporations for municipal purposes; for projects where the power is used for irrigation or temporary construction of power works.

A nominal rental charge is made for all other power projects. It is based on the capacity of the site and is fixed at rates varying from 10 cents per h.p. capacity for the first year to $1.00 for the tenth year, subject to a revision at the end of each ten-year period.

THE STRAIGHT LINE DIAGRAM.

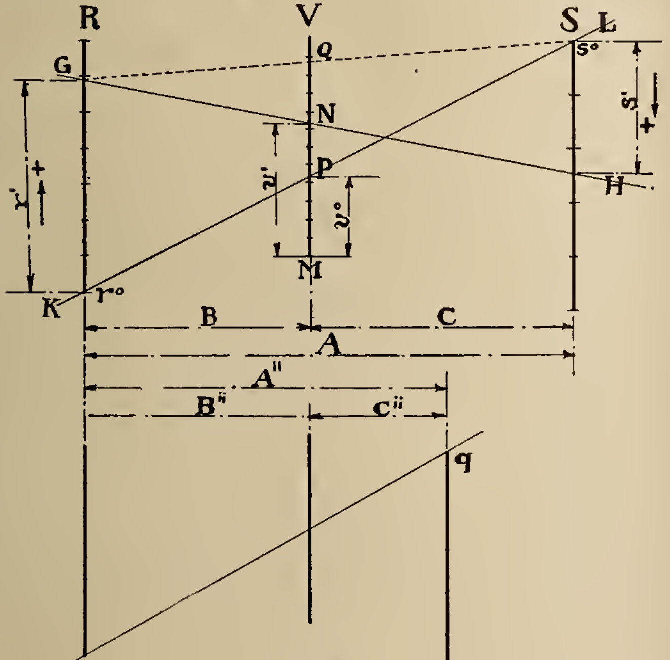
BY J. P. ZIPF.

The straight line diagram offers a quick means of finding the value of any term in either equation

$(1)\ldots\ldots v = C r^m s^n$

$(2)\ldots\ldots v = C' r^t Q^p\ldots C$ and C' being constants if the value of two of the other terms in either equation are known. This is accomplished by drawing a straight line through the known values, intersecting the "unknown" scale at a point, which by its location and graduation, fulfills the above equation.

Arrange three parallel lines, R. S and V, choosing a suitable scale for the graduation of one of these lines, say V. Then "v" units along V will represent v, although the same distance laid off along R or S may not represent either r or s. The positive direction along R is upward and along S downward, with the position of r^o, s^o anywhere along their respective lines. A line (KL) is drawn through r^o, s^o, intersecting V at P and $PM = v^o$. Any other line (GH) drawn through r', s' intersects V at N and $NM = v'$. Then from the figure (Fig. 1)



(Fig. 1)

$$NM = v' = MP + PN$$
$$v' = MP + PQ - QN$$
$$v' = v^o + PQ - QN$$

Also $PQ : r' :: C : A$, $PQ = C r'/A$

$QN : s' :: B : A$, $QN = B s'/A$.

$$(3)\ldots\ldots v' = v^o + \frac{C r'}{A} - \frac{B s'}{A}.$$

Hence any equation which can be written in the form of (3) can also be laid out in the form of a straight line diagram.

(1) and (2) can be written in logarithmic form.

$(4)\ldots\ldots \log v = \log C + m \log r + n \log s$

$(5)\ldots\ldots \log v = \log C' + t \log r + p \log Q,$

which are in the form of (3), R. S and V, being divided logorithmically but with the positive direction along S and Q reversed.

Graphically the diagram is very easy to construct. After R and S are laid down and arbitrarily graduated, values of s are computed for $r = 10$, $v = v'$, and $r = 100$, $v = v'$, the position of V being determined by the intersection of these two lines, and parallel to R and S. The position of $v = 10$, $v = 100$ are found for selected values of r and unknown values of s, thus permitting the graduation of V.

By this graphical method no account is taken of the ratios $\frac{C}{A}$ and $\frac{B}{A}$, these coming what they will with the arbitrarily graduated R and S.

It is interesting to note the relation existing between the several parts of the diagram. Referring to (3) $\frac{C}{A}$ and $\frac{B}{A}$ are geometrical properties of the figure.

$$C + B = A \text{ and } C = A - B$$

$$(6)\ldots\ldots \frac{A}{C} = \frac{A}{A-B}$$

B and C may be chosen to give any convenient ratio.

Comparing (3) and (4)

$$\frac{C r'}{A} = m \log r \text{ and } \frac{B s'}{A} = n \log s$$

$$(7)\ldots\ldots r' = \frac{A}{C}\, m \log{}^* r.$$

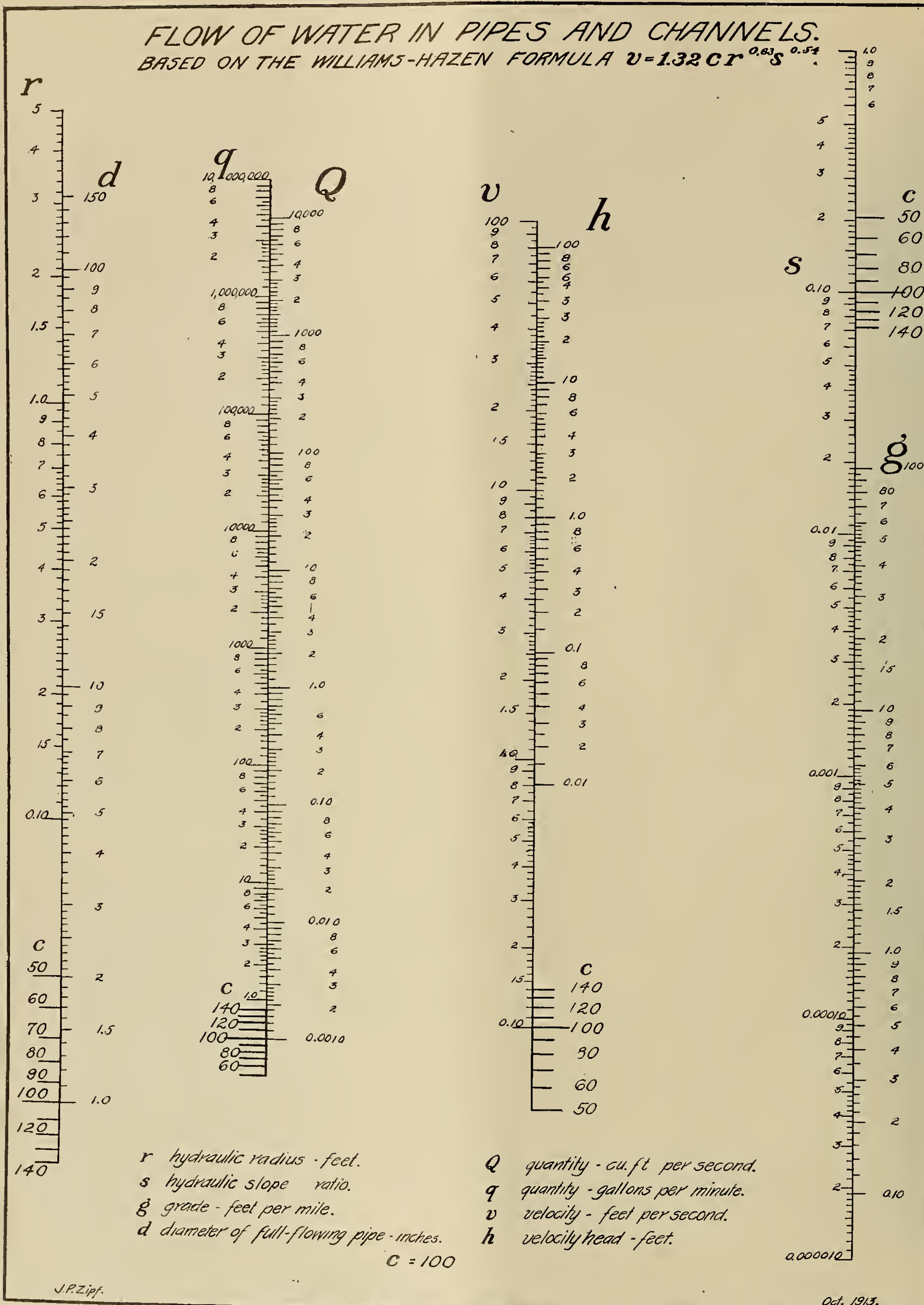
$$(8)\ldots\ldots s' = \frac{A}{B}\, n \log{}^* s.$$

$\log{}^* r$ and $\log{}^* s$ have a special meaning, borrowed from (3). If in (4) the distance $v = 10$ to $v = 100$ be measured by D centimeters (or inches) this scale serves also to measure log r and log s in a manner similar to the logarithmically divided scale of a slide rule, and algebraic addition along a line so divided of the quantities.

$$\log C + m \log r + n \log s$$

results in log v on the same scale; but in the straight line diagram with a unit of D cm. along V there results along R a corresponding unit of $\frac{A}{C}\, m\, D$ cm., and along S, $\frac{A\, n\, D}{B}$ cm. embrace the same unit.

Then if the position of R, S and V be chosen, which is equivalent to choosing B and C, the unit distances to be graduated along R and S are as above, but before V can be graduated the position of v^o is found by connecting r^o, s^o, as in the figure, r^o, s^o, being


FLOW OF WATER IN PIPES AND CHANNELS.
BASED ON THE WILLIAMS-HAZEN FORMULA $v = 1.32\,C\,r^{0.63}s^{0.54}$.
r hydraulic radius - feet.
s hydraulic slope ratio.
g grade - feet per mile.
d diameter of full-flowing pipe - inches.
C = 100
Q quantity - cu. ft per second.
q quantity - gallons per minute.
v velocity - feet per second.
h velocity head - feet.
J.P.Zipf.
Oct. 1913.

(Fig. 2.)

the points $r = 1, s = 1$, since $\log 1 = 0$. $v^0 = \log C$ gives a starting point for the graduation of V.

In order to add (2) to the diagram, we have in a manner similar to (3)

$$(9) \ldots . v'' = v''^0 + \frac{C'' r''}{A''} - \frac{B'' s''}{A''}$$

and equating corresponding terms of (9) and (5)

$$\frac{C'' r''}{A''} = t \log * r.$$

$$(10) \ldots . r'' = \frac{A''}{C''} t \log * r.$$

For the same numerical value of r (7) = (10)

$$\frac{A}{C} m \log * r = \frac{A''}{C''} t \log * r.$$

$$(11) \ldots . \frac{A''}{C''} = \frac{A\,m}{Ct} = \frac{A''}{A''-B''}$$

$$(12) \ldots . \text{calling } \frac{Am}{Ct} = K, \text{ and } B'' = B, \text{ from the figure.}$$

$$(13) \ldots . A'' = \frac{K}{K-1} B.$$

which locates the scale for value of Q.

In the same manner as before the unit distance along Q is $\frac{A''}{B''}(-pD)$ cm. and the logarithmic graduation of Q is started at $v^{0''} = \log C'$.

If in addition to (1) and (2) we have a relation that

$$(14) \ldots \ldots r = c\,w$$

or (15)....$r - c\,w^1$ a scale for w can be substituted for that of r, or what is the more flexible arrangement, the line is graduated for values of r on one side, and for values of w on the other.

From (14) $\log * r = \log * c + \log * w$. The position of w^0 therefore differs from that of r^0 by the distance $\log * c$, on the same unit scale as the logarithmic division of r.

From (15) $\log * r = \log * c + 1 \log * w$. The term $\log * c$ has the same meaning as before and from what follows (7) $w' = \frac{1}{1} \frac{C}{(A\,m\,D)}$ cm. where w' is the unit distance graduated logarithmically to form the scale for W.

The constant C of (1) may have a number of values, as it does in the case of the maximum bending moment of a simple beam, where BM = cWL, W being the total load on the beam and L the distance between supports ($c = \frac{1}{2}, \frac{1}{4}, \frac{1}{8}$ or 1), but only one straight line diagram can be constructed for the equation. If the diagram is constructed for C_1, values of v for C_n will be proportional to the values of v as read from the diagram, the proportional ratio being

$$(18) \ldots . \frac{C_n}{C_1} \text{ or } \frac{C_1}{C_n}$$

If in (1) v is unknown the direct ratio is used, but if s is the unknown the inverse ratio is used. This is easily seen if the equation is written with the unknown on the left hand side, the known terms then being on the right.

To save subsequent multiplication by the factor $\frac{C_n}{C_1}$ the scale of V might have several graduations applied to it, so that readings could be made directly by referring to the proper scale. With the logarithmic graduation of the scales of the diagram, the variation of the constant is very easily controlled by the shifting of the scale, or by the addition of the quantity $\log * \frac{C_n}{C_1}$; the latter being the most expedient, for $\log * \frac{C_n}{C_1}$ is very easily added to the point of intersection of the "straight line" and the scale by means of a pair of dividers, and the corrected scale reading obtained.

If all the exponents of (1) and (2) are unity, logarithmic graduation is not necessary, a simple arithmetical scale being sufficient. This is evident from (3). A logarithmic division of the scales would be useful if a diagram having the same relative precision throughout its range is desired.

Equations (1) and (2) have been chosen with the idea of illustrating this article. The Williams-Hazen formula for the flow of water in pipes and channels is (Fig. 2.)

$$(19) \ldots . v = 1.32\, C\, r^{0.63} s^{0.54}$$

v = velocity of flow in channel; ft. per second.

C = a constant ranging in value from 50 to 140, depending on the surface of the channel. It is here taken as 100.

$$r = \text{hydraulic radius in ft.} = \frac{\text{Area,}}{\text{Wetted perimeter}}$$

s = slope of channel; a ratio.

Choosing B as 18 cm., and C as 12 cm., A is then 30 cm.

The distance $v = 1$ to $v = 10$ was taken as 10 cm. = D.

In the reduced cut, the several parts will be in this proportion.

From (7) the distance $r = 1$ to $r = 10 = \frac{30 \times 0.63 \times 10}{12}$

$= 15.75$ cm.

From (8) the similar distance on S is $\frac{30 \times 0.54 \times 10}{18}$

$= 9.00$ c. m.

The R and S scales are located and graduated, starting from convenient positions of r^o and s^o. On the "v" scale, $\log 1.32C = \log 132$ from which the graduation of V is started.

If the conduit is a pipe flowing full, $r = \frac{d}{4}$ where d is the diameter in feet; or $r = \frac{d'}{48}$, d' being the same dimension in inches, and from (14) $r^o = d^o + \log 48$, or d^o is at 48 on the scale of R. The line is then graduated on one side for values of r and for values of d' on the other.

(21)....$v = 183.4\, d'^{-2}\, Q$, which is similar to (2).

Q = quantity in cu. ft. per second.

$$\text{From (12)}\quad K = -\frac{30}{12} \times \frac{0.63}{2.00} = -0.7875.$$

$$K - 1 = -1.7875$$

$$\text{Hence } A'' = \frac{-0.7875}{-1.7875} \times 18 = 7.93 \text{ cm.}$$

The distance $Q = 1$ to $Q = 10$ is $-\frac{7.93 \times 1 \times 10}{18}$ $= 4.4$ cm.

The — sign here indicates that the graduation of Q increase upward, since C'' is also negative.

The other substitute scales are added from well known relations, and need no explanation.

The colored prisms to be used in the novel and striking scheme of night illuminations of the Panama Pacific exhibit palaces are of fine cut glass made in Austria by a process not followed elsewhere. These prisms, to be known as jewels, are patiently hand tooled in the homes of artisans.

WHITE RIVER ELECTRIC SIGN.

The White River hydroelectric station of the Puget Sound Traction, Light and Power Company is located at Dieringer, twenty-eight miles from Seattle and thirteen miles from Tacoma, alongside one of the main traveled country roads between Seattle and Tacoma, and in plain view of the passing transcontinental trains of the Northern Pacific, Great Northern, Chicago, Milwaukee and St. Paul, Oregon-Washington R. R. & N. Company (Union Pacific), Southern Pacific and the Burlington Route, as well as the Seattle-Tacoma interurban trains, and can readily be seen from the Pacific highway.

It was thought that considerable advertising value would be derived from an electric sign on top of the station. In July, 1912, suggestions were requested from the employes of the company for a suitable design for such a sign. From the many designs submitted, one by W. N. Gordanier, superintendent of the Electron power plant, was selected. The original arrangement of the names of the towns was in geographical order from south to north, reading "Tacoma-Seattle-Everett-Bellingham." Mr. A. W. Leonard suggested arranging the names of the towns in geographical order from north to south, so that the first letter of each city would spell the word "Best" upon flashing out all of the other letters in the name of each city,, and finally after the flashing operation leaving the sign to read "Reliable Power"—"Best Light Service." The letters in these words are in red, and the remaining letters in each city name come on by cities until the names of the cities are spelled out in full. The waterfall, as well as the boiling effect of the water at the bottom of the falls, are very realistic and beautiful.

The sign is 200 feet long and 54 feet high, contains 96 letters (the largest of which is 8 feet high), and is supported by eighteen tons of steel frame work. It carries 4000 30-watt carbon lamps and requires 120 kilowatts for its operation.

White River Sign—Puget Sound Traction, Light & Power Co.

FACTORY LIGHTING AND WORKMEN'S COMPENSATION.

The State of California Workmen's Compensation, Insurance and Safety Act (Boynton) which becomes effective January 1, 1914, contains clauses of especial interest to the electrical interests and closer familiarity with the requirements of the act may open up new channels for improved standards, together with the remodeling of existing lighting installations.

In the past, appeal for better lighting has been made to the employing interests upon the grounds that it meant increased output, better workmanship and a minimum spoilage. There now enters another and perhaps stronger factor to be considered, viz: the safety or protection of employes.

In the East, poor artificial illumination of workshops has been construed by the courts as contributory negligence on the part of employers where such poor illumination existed at the time an accident occurred.

In the Boynton Act (Chapter 176 of the Laws of 1913), no specific mention is made of good lighting as a factor of safety, but sub-section 9 of section 52 reads:

The terms "safety device" and "safeguard" shall be given a broad interpretation so as to include any practicable method of mitigating or preventing a specific danger.

It is probable that inadequate, inefficient or otherwise unscientific lighting constitutes a specific danger.

The employers' liability to provide reasonably safe employment is very definitely stated in section 52, which is as follows:

Every employer shall furnish employment which shall be safe for the employes therein and shall furnish a place of employment which shall be safe for employes therein, and shall furnish and use such safety devices and safeguards and shall adopt and use such practices, means, methods, operations and processes as are reasonably adequate to render such employment safe, and shall do every other thing reasonably necessary to protect the life and safety of such employes.

It is somewhat early, although not too early, to anticipate just what the commission will order as regards illumination standards made by them under sub-sections 1 and 2, of section 57. To date, no rules have been published, although liability of employers under this Act commences upon the day on which the Act goes into effect.

Early in this year, the committee of the Illuminating Engineering Society on factory lighting, made certain recommendations to the New York Legislature bearing upon factory lighting and as a result, Bill No. 26 of the laws of the State of New York, entitled, "An Act to amend the labor law, in relation to the protection of employes operating machinery, dust creating machinery and the lighting of factories and workrooms," was signed by the governor April 17, 1913.

The section of the bill which relates particularly to the lighting of factories, passageways and workrooms, is as follows:

All passageways and other portions of a factory and all moving parts of machinery which are not so guarded as to prevent accidents, where, on or about which persons work or pass or may have to work or pass in emergencies shall be kept properly and sufficiently lighted during working hours. The halls and stairs leading to the workroom shall be properly and adequately lighted, and a proper and adequate light shall be kept burning by the owner or lessee in the public hallways near the stairs, upon the entrance door and upon the other floors on every work day in the year, from the time when the building is open for use until the time it is closed in the evening, except at times when the influx of natural light shall make artificial light unnecessary. Such lights shall be so arranged as to insure their reliable operation when through accident or other cause the regular factory lighting is extinguished.

All workrooms shall be properly and adequately lighted during working hours. Artificial illuminants in every workroom shall be installed, arranged and used so that the light furnished will at all times be sufficient and adequate for work carried on therein, and so as to prevent unnecessary strain on the vision or glare in the eyes of the workers. The industrial board may make rules and regulations to provide for adequate and sufficient natural and artificial lighting facilities in all factories.

It is not to be expected that the Industrial Accident Commission of the State of California will draft rules any less complete and if such be the case, then it is necessary that all interested central station salesmen, engineers, contractors and supply salesmen, should make an early and special study of this important subject of factory lighting for the narrowest construction which can be placed upon the Act shows that it is necessary that all factories be lighted properly and in accordance with the most advanced principles of scientific illumination.

Considerable educational effort is essential, for much has to be accomplished in a short time. The requirements are revolutionary. It has been the practice in the majority of installations to give the least possible attention to this subject of correct lighting and only a salesman of factory lighting reflectors, or an illuminating engineer, know just how difficult it is to instil into the minds of employers the necessity for adequate lighting equipment notwithstanding the demonstrable fact that "it pays." Pays because of a possible increased output, reduced spoilage, improved product, and the reduction of accident risks to a minimum.

Is the industry prepared to properly cope with the condition? It will certainly pay us to take inventory not only of stocks but of our knowledge and take whatever steps are necessary to remedy the shortage in either, for business flows to the firm that can handle it and prospects to the man who knows how.

Increased production of natural gas in California during the year 1912 was most marked. The total production as estimated by E. W. Parker of the United States Geological Survey was 9,354,428,000 cubic feet, value at $1,747,379, compared with 6,389,820,000 cubic feet, valued at $800,714, in 1911. The larger portion of the natural gas produced in California is consumed in the industries, the estimated quantity in 1912 being 8,379,632,000 cubic feet. Only 974,796,000 cubic feet was consumed for domestic purposes, but these figures are almost double those for 1911, the number of domestic consumers having increased from 10,598 in 1911 to 18,171 in 1912.

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POWER AND GAS

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Technical Journal Service

Jones dropped back into his chair wearily, and the sigh that escaped was one of defeat. It was bitter too, for reliance had been placed in him to complete the project; he had gone into the work cheerfully and with confidence, and now—nothing, that's all, for his mind refused to think, although he seemed to know somehow that he was defeated, and the knowledge stunned him.

The problem to be worked out had taken all his time for months past. New and unique methods had to be tried out, and now at the critical time, invention failed him and the necessary solution would not come. He had tried all the regular avenues of relief but always with the same despairing results; and then the Morris chair engulfed him, nature came to the rescue and he was asleep.

* * * * * *

From the table and out across the room floated a dagger. It was unreasonable, but somehow Jones was not afraid. Cross-hilted it seemed to suggest salvation and with curiosity stretched to the point of impatience he watched its approach. It came, waited, and Jones understood that his part was to follow. How far? Just across to the corner of his study where lay an accumulation of technical mail. Jones stooped, and the act awakened him, causing him at the same time to involuntarily sweep his hand across the corner of his study table whereon lay a paper knife, a cross-hilted affair he had brought from Old Mexico, and it fell in the corner, just where Jones' dream had broken off.

It was too much of a coincidence. Picking up the first magazine which happened to be a copy of the Journal of Electricity a month old, Jones tore off the wrapper and the first thing he lighted upon was an article describing how a fellow engineer had solved an exactly similar problem elsewhere. An article given in a spirit of greatness which claims no property in truth and which realizes that we are made for co-operation; that we gain good by giving it.

"Just one month of worry might have been saved," soliloquized Jones, "had I but had the forethought to take advantage of the engineering service for which I paid and which incidentally cost so little. For the small sum of five cents weekly I have had the privilege of consulting the master minds of this science, the leading men of the day, and did not take advantage of it."

Then Jones made a resolution, and do you wonder why it is that he is now a regular reader?

Diversity Factor

Some terms encourage investigation but others more formidable in appearance are often dismissed from thought and so become shrouded with mystery. A vague term such as "depreciation," is bewildering to the uninitiated, but a term such as "diversity factor" which merely expresses the ratio of two factors should certainly be capable of simple explanation.

It is possible for a restaurant having a seating capacity of only one hundred, to serve no less than five hundred people at each meal. The reason for this is

self-evident. All people do not eat at the same hour. Waiters to serve one hundred are sufficient for all. It is also true that the restaurant keeper is able to estimate with a degree of accuracy the quantity of food he must supply. Although the appetites of patrons vary continually the estimates made are by no means guess work, as these variations, under the law of averages, generally neutralize each other. Usually in the summer seasons business is not so good because less food is required and although more people may be served at lunch each day, less is eaten than for the late dinner, and so this meal becomes the most profitable. Illustrations might be multiplied, but enough has been mentioned to bring out the factors which enter into a consideration of this question of diversity factor.

With a limited seating capacity the central station is enabled to literally feed the five thousand with but five barley loaves and two small fishes. From the viewpoint of low price due to the saving in service costs this is advantageous to the consumer, for among a group of customers served from one transformer or bank of transformers there will be a difference both as regards the time when used, hours use, and proportion of individual connected load (or more correctly, of individual maximum demand), used. This diversity of demand permits the installation of a much smaller transformer capacity than would be necessary if the maximum demand of each customer occurred at the same time. The same is true of generating equipment as well as distribution system, and this diversity factor which permits more than one customer to be served from the same equipment results in a saving in investment which, together with other factors, permits a charge for electric service which places it within reach of all.

The capacity of every central station generating equipment is less than the total individual maximum demands of all customers or even the combined maximum demands of the different classes of customers. All do not demand power from the company at the same time. For example, the business and commercial districts will during the winter months make their maximum demand for light at about 4 and 5:30 p. m., and the residence lighting load will begin to increase at about that time and reach its maximum at about 7 p. m. The "appetite" of each customer for light also varies. Tonight one house entertains and uses more light, tomorrow another, and so on.

In central station practice the term "diversity factor" is used to express the relation between the simultaneous demand of all individual customers and the sum of the maximum demands made by them; the sum of the maximum demands of the customers, no matter at what time they occur, divided into the simultaneous greatest maximum demand at the generating station or sub-station, expressed in per cent.

Similarly, the diversity factor of an installation is the sum of the maximum demands of the various units of which it is comprised divided into the greatest maximum demand of the entire installation and expressed in per cent.

The latter is easily calculated, but the central station diversity factor is a more complicated though interesting study. One too, which will amply repay considerable time and trouble spent in its consideration because of ts important bearing upon the cost of service.

Analysis of diversity factor is of importance in determining the investment required in the various parts of the distribution system for each kilowatt of maximum demand and hence the amount of the fixed charges which should be made to each customer.

Machine Shop Electrification

An article describing the power equipment of the Union Iron Works Company in this issue forms an interesting study of construction methods, and explains the conditions responsible for the radical changes made and the ideas adopted. The author, the company's electrical engineer, describes the reconstruction due to the rapid growth of business and the increase in the efficiency of present day machinery and methods rendering those of yesterday obsolete, though not outworn.

A progressive company must keep pace with progress.

The article is strong technically and should prove of value to all our readers. It is not surprising to learn that engineers visiting this plant are invariably astonished at the rapid advance which has been made in machine shop electrification as evidenced in this installation, and fully described in this article.

A careful study of the requirements of this plant and the reasons leading up to the adoption of individual electric drive and central station power service would equip the central station power salesman with many arguments which would contribute materially to his success in closing contracts for new business of this nature.

In such a large plant the many and varied application of power to ship-building and repair work, none of which pull power continuously from the supply system, creates a great diversity of demand, the greatest call on the power company at any one period being much less than the sum of the individual requirement of each machine: In this plant, this diversity factor—the ratio of the sum of the maximum power demands of the various units comprising this system to the maximum demand of the whole installation—approximates twenty per cent, which fact was fully utilized in the wiring design.

The electric motor and equipment salesman may also gather many valuable sales arguments in perusing this article. Every prospective customer wants the best—that which will most satisfactorily do the work—at the lowest possible cost, and if salesmen and specialists of all kinds would but take such opportunities as are here presented to acquire and perhaps file for future reference, working information of worth, sales would be much more easily made. When we know what is best for the prospect's requirements the better things are invariably sold.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Sylvester M. Baker, Macbeth, Evans Glass Company, is at Vancouver, B. C.

Frank Cook, representing the Ohio Brass Company, was at Salt Lake City recently.

R. D. Holabird, who has been visiting eastern factories, has returned to San Francisco.

Hugh Bargion is now manager of the Washington Electric Supply Company, Spokane, Wash.

J. W. Heap, Willits Water & Power Company, was at San Francisco last week on business.

G. R. G. Conway, chief engineer B. C. Electric Railway, Vancouver, B. C., is on a visit to New York.

H. W. Crozier, engineer with Sanderson & Porter, San Francisco office, is making an inspection trip to Idaho.

Chas. Corfield has been appointed chief electrician of the Utah Copper Company's plants in Utah and Arizona.

J. Presbey, Holophane Works of G. E. Company, is visiting cities in Northern California, Oregon and Washington.

Chas. Hoy, purchasing agent of the Reno Light & Power Company, Reno, Nev., was a visitor in San Francisco during the week.

H. C. Rice of the General Incandescent Lamp Works of G. E. Company, was at Salt Lake City on business during the past week.

R. B. Mateer, load factor builder, has returned to San Francisco from a tour of inspection of electric power plants in Southern California.

S. J. Keese, manager of the Westinghouse Electric & Manufacturing Company, Los Angeles, spent the latter part of the week in San Francisco.

H. T. Van Riper, representing the Hotpoint people, stopped off at Salt Lake City on his way to Denver on special business for his company.

T. M. Stateler, salesman with the Pacific States Electric Company recently returned from a two weeks' business trip through the southern part of the state.

Leo Brandenberger will in future have charge of the power section, Utah Power & Light Company, Salt Lake City, and **J. F. Derge** the lighting section.

Miles F. Steel, salesman with the Benjamin Electric Manufacturing Company, has returned to San Francisco from an extended trip through the Pacific Northwest.

Frank S. Easton returned to Vancouver, B. C., via Los Angeles and San Francisco. While east he attended the convention of the American Institute of Civil Engineers.

P. E. Overend, formerly with the Northern Electric & Manufacturing Company, Vancouver, B. C., has joined the sales department of the Pacific States Electric Company in Portland, Ore.

C. C. Hillis, general manager and treasurer, Electric Appliance Company, San Francisco, has left for an extended trip East. Mr. Hillis will attend the Jobbers' Convention at Hot Springs, Va.

E. J. Cochrane, chief efficiency electrical engineer with the Sydney Municipal Council, Sydney, Australia, is inspecting the various Pacific Coast power plants, having spent the past week in San Francisco and vicinity.

L. R. Jorgensen, engineer with F. G. Baum & Company, has returned to San Francisco from a trip made to Juneau, Alaska, in order to inspect the Jorgensen arched type dam installed by the Alaska-Gastineau Mining Company.

A. M. Hunt, consulting engineer and chairman of the paper's committee for the International Engineering Congress at San Francisco in 1915, will leave for an extended eastern trip next week in connection with the Congress work.

A. O. Boniface, special travelling agent for the Underwriters' Laboratories, is returning to Chicago by way of Portland and Seattle after a month's conference with various Pacific Coast manufacturers of approved and labelled goods.

J. Nadon has joined the sales force at the Westinghouse Electric & Manufacturing Company, San Francisco. Mr. Nadon is a graduate of the University of Nevada and also of the preparatory school of the Westinghouse Company at East Pittsburgh.

George Hoxie of New York, **C. L. Cory** of the State University at Berkeley and **C. W. Koiner** of Pasadena have been recommended by the public service committee of the city council of Los Angeles to make estimates of the amount of money needed for the completion of the power plants, and a distributing system required in connection with the aqueduct project.

MEETING NOTICES.

Jovian Electrical League of Southern California.

The regular meeting of the League was held at Christophers at 12 noon on November 12th, with Mr. Charles S. Walton in the chair. The meeting listened to two papers, one on "Are You Living and Making a Living?" by Reynold E. Blight, and "Electric Trux," by Harry W. Harrison.

Electrical Development and Jovian League—San Francisco.

The regular monthly business meeting was held Tuesday, October 11, 1913. Reports of committees and routine business was transacted. A nominating committee consisting of Messrs. F. Poss, S. Walton and P. B. Hyde was appointed to select candidates for the offices of president, vice-president, secretary-treasurer and two members of the executive committee and report at the December 9 business meeting.

Utah Electric Club.

At the regular luncheon of the Utah Electric Club at the Commercial Club last Thursday, plans for the winter's business and entertainment were discussed. Chester P. Cahoon, manager of the Progress Company of Murray, chairman for November, presided. Committees were appointed to arrange for socials, lectures and other forms of entertainments.

Mr. J. C. Jones, local manager of the Westinghouse Electric and Manufacturing Company, was elected chairman for January.

Oregon Society of Engineers.

The local Chapter of American Institute of Architects and the Oregon Society of Engineers held an informal luncheon at the Portland Commercial Club in honor of Mr. G. Alexander Wright of San Francisco, who addressed them on "Quantity Surveying."

The idea of "Quantity Surveying" is for the architects to definitely specify the quantity of each kind of material thereby placing the contractors all on the same basis instead of asking them to furnish enough material to conform to the specifications and drawings.

TRADE NOTES.

Mr. A. L. Bowen, consulting engineer, has moved his offices from 1026 Henry Building, to 810-811 Hoge Building, Seattle, Wash.

Mr. Thomas Morrin, consulting mechanical engineer, announces the removal of his offices from the Balboa Building to 547 Phelan Building, San Francisco.

The Steel City Electric Company, Pittsburg, Pa., announce the appointment of the Ohio Distributing Company, Hearst Building, San Francisco, as their sales representatives in the central western states.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION

An excellent paper was submitted at the last meeting by C. F. Butte, the main purpose of which was to suggest methods by which the membership could be increased and the Association made of more value to the members.

The paper was referred to a committee which was instructed to analyze Mr. Butte's paper more carefully and suggest whatever would be immediately practicable. The following suggestions were submitted by the secretary and later adopted:

1st. That a prize of $50.00 be offered to the man securing the greatest number of members during the next six months, commencing November 1st.

2nd. That a committee be appointed to study and report on the feasibility of a central buying point.

3rd. That a committee be appointed to study the possibilities of a central estimating quarters and a universal estimating scheme.

4th. That a committee be appointed to study and report on the advisability of gathering through the central office advance building information, which information is now paid for by each firm separately.

5th. That a committee be appointed to work out a delivery system. (It is suggested that a contract be made with a large teaming firm under which all deliveries could be made promptly and at a uniform charge, depending upon delivery.)

The above committees were appointed.

The report continues: You have the price and data book committee, which should be encouraged to continue this work by every member helping and sending out data that will be useful to other members.

With reference to stimulating interest in meetings, every member should consider himself a committee of one to obtain speakers for the meetings, and, in fact, bring up any live subject that would be of interest to the other members.

Too much cannot be said of the last paragraph of Mr. Butte's paper having reference to burying individuality.

Just think for a moment what a grand organization this would be if every member would cast aside any thought that would in any way be detrimental to the electrical contracting business as a whole. We are all here to make money, but at the same time I think that at the present time that by putting self first we are tearing down so fast that our progress is very slow.

A great deal depends on your secretary, but remember he is in the position of trying to guide you into the narrow lane which we call "success."

You are all pulling different ways, maybe not intentionally, but thoughtlessly—some by placing individuality above the general good, some by carelessness, some by greed, some by thoughlessness.

Let us stop for a minute and see what this means. It means dissatisfaction, and often dissolution, which means you must start all over again.

Now let us have the other side.

A successful association means satisfaction and progress. If your association were a success you would all be successful. Is the goal not worth working for?

Just realize that there is nothing we could not do if every man in this organization would think and do nothing that would be detrimental to the organization, would boost it every time he met a contractor who was not a member. Get the association talked about. Remember the little things the association does for you, and the time would not be long before you would have contractors trying to get in instead of having to seek them.

NEW CATALOGUES.

(Under this heading attention is directed to catalogues and bulletins representing the latest information upon the subjects treated. The latest developments are always in advance of the most up-to-date text books. Readers are urged to write direct to the publishers for these catalogues and bulletins which, unless otherwise stated, are available for free distribution.)

"Thyssen," entrainment vacuum pumps are fully described in Bulletin No. 15 issued by the C. H. Wheeler Manufacturing Company, Philadelphia, Pa.

"Mineral Production for 1912," compiled by E. S. Boalich, Statistician, California State Mining Bureau, is the title of Bulletin No. 65, the latest publication of that Bureau. Comparative data is given and also the mineral production by counties.

An envelope stuffer on industrial lighting fixtures has been issued by the Benjamin Electric Manufacturing Company, Rialto Building, San Francisco, which describes that company's line of reflector sockets, industrial clusters, mill clusters and gas and vapor-proof fixtures.

Gleason Tiebout Glass Company, New York, are taking advantage of the opportunity presented in introducing new lines of semi-indirect illuminating glassware, to invite the public to inspect same at their various show rooms. Complete catalogue is sent on request.

The baby sales stimulator sent out under the name of the National Miniature Mazdafier by the National Lamp Works of General Electric Company, Cleveland, Ohio, is devoted to National Mazda miniature lamps. If you are interested in the sale of miniature lamps you will find the "Mazdafier" a fresh monthly fund of clever sales ideas, novel window displays and new advertising helps, which will aid you in building up a profitable business in miniature lamps.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The railroad commission issued a supplemental order in which it allowed the Tulare County Power Company to carry to completion its proposed issue of notes in the sum of $250,000.

A decision was rendered granting authority to the Reedley Telephone Company to issue $2,500 of stock.

The Southern Sierras Power Company was granted authority to renew $10,000 of promissory notes for the purchase of property of the Lytle Creek Power Company.

The United Light & Power Company was granted authority to issue a note in the sum of $6000.

A decision was rendered granting authority to the Pacific Telephone & Telegraph Company to issue $3,000,000 of bonds. The proceeds will be devoted to retiring $850,000 of underlying bonds and to improvements in the company's plant.

The San Diego & Arizona Railway Company applied for authority to issue $15,000,000 of bonds for the construction of a line of railway from the city of San Diego to Yuma, Arizona.

A decision was rendered granting authority to the Pacific Light & Power Corporation to issue $52,300 of stock. The company was denied permission to issue $1,720,000 of bonds.

A decision was rendered granting to the San Diego Consolidated Gas & Electric Company to issue $27,000 of bonds for additions and betterments to the company's plant.

The Spring Valley Water Company was granted authority to issue a promissory note in the sum of $300,000. The proceeds will be used for new construction and to pay off mortgage indebtedness.

A decision was rendered granting authority to the San Francisco Chamber of Commerce, reducing the rate on clay on the Southern Pacific into South San Francisco, East Oakland and Alameda from $1.25 to 85 cents per ton. The clay is shipped from points in Amador, Placer and Calaveras counties.

A decision was rendered granting authority to the Dos Palos Telephone Company to issue $1,273 of stock.

NEWS NOTES

FINANCIAL.

LOS ANGELES, CAL.—There is a possibility that the city council may revise its original plan on the power bond issue and pass an ordinance providing for segregation of the two propositions—the one to vote $1,250,000 for the completion of the city's power plant; the other to vote $5,250,000 for the purchase of a distributing system of electrical energy.

INCORPORATIONS.

MYRON, UTAH.—The Myron Electric Light, Water & Power Company has been incorporated here.

LOS ANGELES, CAL.—The Citrus Mesa Water Company has been incorporated.

ILLUMINATION.

PORT ANGELES, WASH.—The franchise applied for by Dann Bros. for a gas plant has been granted.

LEBAM, WASH.—R. L. Fisher has applied for a franchise to construct, maintain and operate an electric light plant and lines in the town of Lebam.

WHITTIER, CAL.—Work of installing the new system of street lights in the business district has been commenced by the Edison company and will be in operation before the holidays.

LOS GATOS, CAL.—The construction department of the Pacific Gas & Electric Company is preparing to lay new 6-in. gas mains along the entire length of Main street at a cost of approximately $15,000 and along Santa Cruz avenue, preparatory to the paving of these streets.

VANCOUVER, B. C.—It is said that the Vancouver Gas Company has been granted an order restraining the authorities from enforcing an ordinance to put the price of gas at 95 cents per 1000, instead of $1.50. Some weeks ago the city council ordered the cut, the same to become effective during the latter half of October; but the company declared that the city council was usurping the power of the public utilities commission.

SAN BERNARDINO, CAL.—In a lengthy opinion Judge B. F. Bledsoe of the Superior Court gave San Bernardino city a sweeping victory over the local gas companies and sustained the dollar gas rate passed by the city council last winter to become effective March 1st. The Southern California Gas Company had enjoined the city from putting the ordinance into effect, maintaining that the old rate of $1.15 was as low as gas could be profitably sold in this city.

ASTORIA, ORE.—The city of Warrenton will hold a special election on November 28th, for the purpose of voting a special 10 mill tax to secure a fund of $4200 to make surveys and do other preliminary work toward establishing a municipal electric light and power plant. If the water commission makes a favorable report on its investigations an election will be held to decide whether the municipality shall be bonded for making the improvements.

COEUR d' ALENE, IDAHO.—The city council has entered into a contract with engineering experts Burns & McDonnell of Kansas City to do expert work on electric light and water rates charged by the Kootenai Power Company, and the Consumers' Company. The contract calls for the complete audit of the Kootenai Power Company and Consumers' Company books for the last five years, with a detailed report of the receipts and disbursements and cost of maintenance. Upon this will be based the value of the plants. The contract for the work is $2000.

MURRAY, UTAH—Geo. A. Husher, the Socialist candidate for Mayor, was re-elected last Thursday. Mayor Husher was first elected two years ago on a platform declaring for the immediate installation of a municipal electric lighting plant for Murray. The plant has been installed and will be ready within the next few weeks to deliver energy. The administration has announced a rate of seven and a half cents per kilowatt-hour for lighting purposes by the municipal plant, as compared with a ten-cent rate formerly charged by the Progress Company. It is expected that the Progress Company will meet the cut.

SOUTH VANCOUVER, B. C.—The council of the municipality of South Vancouver unanimously passed a resolution calling for the establishment of a municipal electric plant. The report of the municipal electrician provided for constructing on electric light and power plant at a cost of $600,000, being $400,000 for the first unit and $200,000 for the second unit, not including cost of the building, with a capacity capable of supplying the needs of the district for the next five years. The report recommended a 2-unit steam generating plant of the turbo-generator units type, with a nominal rating of 2000 kw. and a maximum rating of 2500 kw. with crude oil as fuel. Provision was also made in the estimate for an adequate system of street lighting, includin 300 arc lamps and standard lamps for the principal sections.

SAN FRANCISCO, CAL.—The installation of the electric conduits for transmission of light and power at the Panama-Pacific International Exposition has kept pace with the rapid progress of construction work in general. The general distributing cables for the trunk system and all the operating apparatus are in order, and also the apparatus for the decorative lighting, such as projectors. The conduits for the trunk system in the concessions and in the states and foreign districts of the grounds are completed and it only remains now to put in the service leads. The system is as far advanced in the main exhibit district as the progress of work on the palaces and the piles of lumber will permit. Plans for the wiring in the Court of the Four Seasons and in the Court of the Sun and Stars have been completed and bids have been called for.

TRANSPORTATION.

PORTLAND, ORE.—Over the vigorous protest of officials of the Portland Railway, Light & Power Company and representatives of several districts of the city, the city commission voted 3 to 2 for the passage of an ordinance fathered by City Commissioner Daly requiring the street car company to grant six street car rides for 25 cents.

SACRAMENTO, CAL.—The West Sacramento Company is preparing for operation of street cars between Sacramento and the townsite in West Sacramento. A 5c fare is promised and the line is scheduled to be in operation within a short time. Engineers have begun laying the tracks. The Pacific Gas & Electric or the Northern Electric will conduct the line.

WATSONVILLE, CAL.—For the second time in its career of ten years the Watsonville Railway between this city and Port Watsonville has started over the road of receivership, suit having been filed in the Superior Court of Monterey County by the Union Trust Company of San Francisco for a receivership. The complainant company is trustee for the $100,000 bond issue.

SACRAMENTO, CAL.—The railroad commission has issued an order supplemental to its previous order in which it provided that an undergrade crossing should be constructed by the Northern Electric Railway Company and the Cement, Tolenas, & Tidewater Railroad Company near Cement, Solano county. The modified order provides that the under

pass shall be completed on April 28, 1914, and that, in the meantime, the Cement, Tolenas & Tidewater Company, operate its trains over the crossing on an approved signal system.

FRESNO, CAL.—The grading crew on the Fresno Traction Company's San Joaquin River extension has completed about two miles of grading in the past three days and rails for the road have been laid to the Santa Fe. The laying of rails beyond the Santa Fe will start at once and will be carried on as fast as grading work is done. The pole line is about half way to the river and the trolley to the river will probably all be strung within the next ten days.

SEATTLE, WASH.—An ordinance providing for the construction of a second division of the municipal street railway will be introduced at the next council meeting by Councilman Erickson. The route will be from Fourth avenue South and Jackson street to Dearborn street, thence to Rainier avenue and paralleling the tracks of her Seattle, Renton & Southern Street Railway to Columbia City, or possibly beyond that point. A $800,000 bond issue was ratified.

OAKLAND, CAL.—The project of establishing a union depot housing the electric traction lines of the city and providing at Fourteenth and Franklin streets a central distributing point for the passenger traffic of the city, may soon take shape. This announcement is made by Secretary A. R. Dennison of the Chamber of Commerce following correspondence and personal conferences with Paul Shoup, in charge of the electric lines of the Southern Pacific Company and several other high railway officials.

VALLEJO, CAL.—The Northern Electric Railroad Company has assembled construction material here for a resumption of the construction work on the Santa Clara street bridge. Assistant Engineer H. O. Brown states that grading operations will be prosecuted throughout the winter. The heaviest work will be through Jamison Canyon. An overhead crossing will be constructed at Napa Junction. The construction crew is working several miles out of Fairfield. Suisun Creek has been reached.

LOS ANGELES, CAL.—The girder-rail ordinance of this city now in effect, cannot, it is said, be enforced on account of the flaws it is supposed to contain which would probably kill the ordinance if tested in the courts, and the revised ordinance now before the council has been laid over for a week on request of the grand jury. The announcement that the grand jury is taking a hand in the situation and that its members desired to compare the old with the new ordinance had the effect of halting action.

OGDEN, UTAH—A force of men are employed by the Utah Light and Railway Company repairing the damage done to the Pioneer Power Plant last week when the accidental opening of a motor operated gate valve at a time when the turbine case was open flooded the entire power station. C. A. Cohn, superintendent of power stations for the company, is in charge of the work. He reports that the damage was not as serious as at first anticipated and that the plant will be back in commission within a few days.

TACOMA, WASH.—President Farrell of the Oregon & Washington Railroad & Navigation Company has announced that a large ocean warehouse will be constructed by his company on its water front property, indicating that the Union Pacific interests intend to make a strong effort for their share of the Oriental freight business. A plan has been submitted to the Tacoma city council by private interests for the purpose of making arrangements to construct an iron smelter upon a vacant tract of land owned by the city on the tide flats. The project is in a preliminary stage.

FAIRFIELD, CAL.—The Northern Electric Railroad has started aggressive action against land owners in the vicinity of the Vallejo terminal, whom the road alleges are holding out for an exorbitant figure for rights of way privileges. Two important suits have been filed and others near the Vallejo end will probably be filed very shortly. Condemnation proceedings may also be necessary through small tracts near Suisun and the Five Mile House near Napa Junction. Outside of these few setbacks the railroad officials declare the prospects for an early completion of the system are very good.

POCATELLO, IDAHO—It was recently announced by J. B. Browning of Pocatello and Cleveland, Ohio, that he had succeeded in interesting Salt Lake and Eastern capital in the installation of an interurban extension from here to Fort Hall, which will run through a rich farming section and tap several of the small towns which lie adjacent to the county seat of Bannock County. It is stated that orders will soon be placed for the steel and that construction work will start as soon as material can be delivered. Mr. Browning was assisted in his negotiations by L. L. Evans of American Falls, Idaho. It is proposed to operate a storage battery system of transportation. The franchise for the system was obtained about eighteen months ago. The storage battery system was decided upon on account of the lower first cost and up-keep as compared with the trolley system.

SAN FRANCISCO, CAL.—The city engineer has about completed the specifications for the hundred new cars which are to be procured for use on the proposed extensions of the Municipal Railway system. Proposals for the construction of the cars will soon be invited, as this will take longer than any other work connected with the enlargement of the city's system. Rails will next be advertised for. The specifications for rails and other roadbed material are also in process of preparation, as well as plans for the new car barn. Condemnation proceedings to obtain the proposed Potrero avenue site have been instituted. The city engineer has completed his inventory and valuation of such property of the Presidio and Ferries system, the franchise of which expires on December 3, as is likely to prove valuable to the city when it takes over the line.

TRANSMISSION.

DALLAS, ORE.—The installation of 282 horsepower in motors at the Dallas Lumber & Logging Company's mill has been completed and the load connected to the lines of the Oregon Power Company.

LOS ANGELES, CAL.—Power was sent over the new Pacific Light & Power Company's transmission system from the new Big Creek project, 241 miles north of this city. This development makes available an additional 80,000 h.p. of electrical energy for use in this city and Southern California.

SAN BERNARDINO, CAL.—It is announced that the Southern California Edison Company will at once commence the erection of a $500,000 plant near Slide Lake to the Santa Ana Canyon, where preliminary work has been under way for some time. The station will be by far the largest one the Edison company will have next to the Long Beach steam plant.

VANCOUVER, B. C.—An early completion is anticipated by T. R. Connick, San Jose, Cal., of the steel tower, 60,000 volt transmission line which he is erecting between Port Moody and the Lake Buntzen power station for the British Columbia Electric Railway Company. Extraordinary difficulties were encountered as the line runs through wild country. For some sections it was necessary to carry water in bags on horses for mixing the concrete for foundations.

MAPLETON, UTAH—The Utah Power and Light Company are building an extension to their lines approximately five miles in length, and are installing a distribution system to serve this community with electric light and power. The Mapleton bench is one of the most prosperous fruit-growing sections in the State of Utah, owing to the fact that it is swept by warm breezes from the mouth of Hobble Creek Canyon during he critical period for fruit. A franchise is being secured to pass through the town of Springville in order to reach here.

ALPHABETICAL INDEX TO ADVERTISERS

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POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

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Alphabetical Index to Advertisers, Page 8. **Where to Buy It in the West, Pages. 9, 10.**

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI | SAN FRANCISCO, NOVEMBER 22, 1913 | NUMBER 21

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ALAMEDA MUNICIPAL ELECTRIC LIGHT PLANT

BY JOSEPH B. KAHN

(The early history is first touched upon by the author, who then describes the recently installed plant and many interesting features in connection with its erection and operation. The system of residence street lighting is also mentioned, and a reason is given for the signal success of the public ownership of this particular plant. Mr. Joseph B. Kahn is the superintendent of the City of Alameda Department of Electricity.—The Editor.)

The Municipal Electric Light Plant of the City of Alameda, California, started in 1890, was for many years operated only as a street lighting system. It was not until 1904 that the city embarked in the commercial lighting business, and then only in a haphazard way. In the year 1905 a 24-hour service was inaugurated and the history of the plant as a commercial enterprise started from that time. The confidence of the citizens in this public-owned utility is expressed in its steady growth and the loyalty shown to the plant through its many trying periods. In 1905 the plant consisted of 1-360 h.p. Buckeye cross-compound engine belted to a 250 kw. Stanley 2-phase induction type generator, and a 90 kw. Stanley generator served by a 150 h.p. Ohmen engine, with a full complement of return tubular boilers. All the plant of that date has been discarded. At the present time, the plant is of modern construction throughout, consisting of 1-500 kw. Westinghouse Parsons turbine, 1-1250 kw. Westinghouse Parsons turbine, one 4-valve Fleming-Harrisburg engine direct connected to one 275 kw. National generator, one piston valve Fleming-Harrisburg engine direct connected to one 240 kw. National generator.

Exterior Municipal Power Plant—City of Alameda.

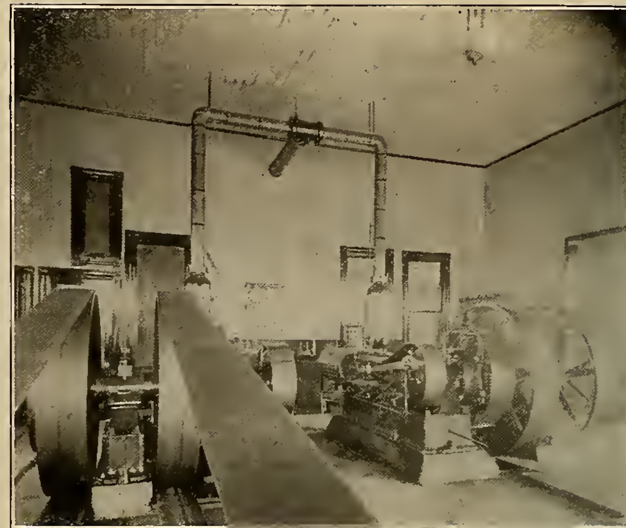
All generators are 2-phase, 60 cycle 2400 volt, and all engines condensing—condenser of the Worthington type, with Blake air pump.

The boilers consist of 2-300 h.p. Stirling and 4-250 Heine boilers, all water tube, carrying 175 lb. pressure and equipped with super-heaters.

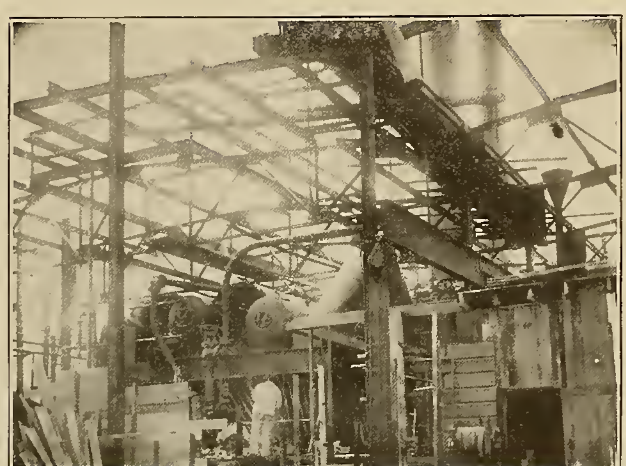
All drain and condensing water from condenser are carried to the hot well, and then through closed meter and coil-heater to boilers.

A deep well Dorward motor driven pump sup-

Exterior View of the Plant Secured in 1890.



Interior View of Street-Lighting Plant, 1890.



The Old Plant Kept in Operation During Rebuilding.

Plant at Commencement of Reconstruction, 1912.

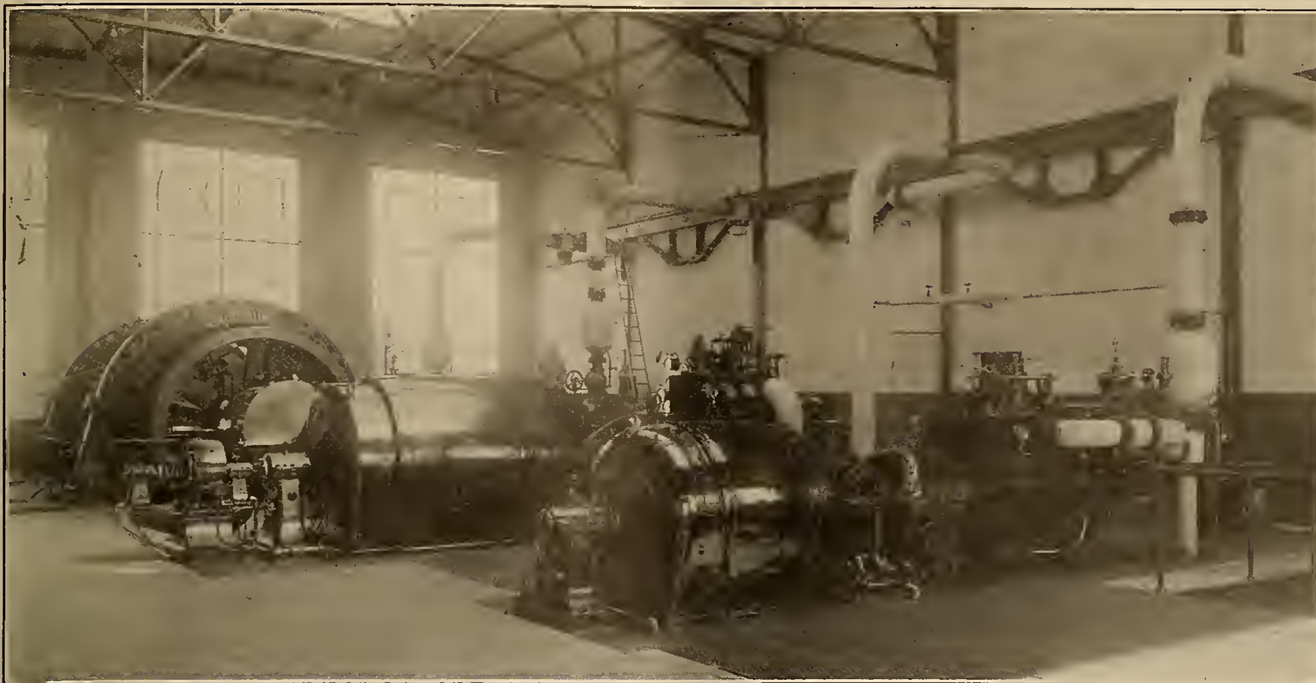
1500 Ft. Pipe Line for Fuel Oil and Saltwater.

Battery of Boilers in New Plant.

plies make up water and other water for station work. A continuous record of the flue gases is kept by use of a carbon dioxide meter.

The switch-board is of the General Electric type, with bell crank handles operating the switches in compartments in an upper gallery, with a double bus bar arrangement. Circuits are all protected with time limit relays, all feeders have a feeder regulator, which automatically regulates the voltage on each.

The people of Alameda voted the necessary $150,-000 for doubling the capacity and for the improvement of this plant in April, 1912, and in December, 1912, construction was commenced. The old building was a ramshackle wooden structure, and the new Class "A" building of steel and reinforced concrete was built around it. Continuous service was essential and was secured during the process of reconstruction, notwithstanding the difficulties encountered, some idea of



Interior View of New Plant.

which can be gathered from the accompanying illustrations.

The assets of the plant now exceed $511,000 and its annual income from public and private lighting and power is $120,745. The net profit last year after deducting all operating maintenance, depreciation and interest charges was $47,538.80. The service is excellent, the voltage variation not exceeding 2 per cent.

The rates for power range from 2c per kw.-hr. to 5c per kw. according to load factor, and from 5c to 7c per kw.-hr for lighting.

The following abstracts from the last annual report will prove of general interest in addition to their value as statistical evidence of the progress of the plant:

Report of Municipal Electric Light Plant for Year Ending June 30, 1913.

EARNINGS.

City incandescent		$ 29,511.28
City arcs		4,196.52
Commercial and private lighting		84,939.45
Commercial and private power		14,615.85
Wiring permits		940.00
Miscellaneous earnings, labor, supplies, etc		3,899.10
		$138,102.20
Less discount	$2,368.95	
Bad debts	106.65	2,475.60
Total gross earnings		$135,626.60

EXPENDITURES.

Production Expense—		
Salaries and wages	$ 13,793.90	
Maintenance of machinery and tools	2,439.74	
Fuel	17,796.60	
Lubrication	550.25	
Tests for foundations	704.30	
Other production expense	486.92	$ 35,771.71
Distribution Expense—		
Salaries and wages	$ 13,790.80	
Maintenance of lines	1,164.16	
Maintenance of street lamps	4,799.72	
Maintenance of line tools	110.19	
Maintenance of automobiles	1,188.50	
Other distribution expenses	1,439.14	$ 22,492.51
General Expense—		
Office salaries	$ 5,932.40	
Stationery and printing	986.69	
Other general expense	202.98	$ 7,122.07
Total cost of production		$ 65,386.29
Depreciation (average rate 6.25 per cent)		16,819.20
Interest		3,854.25
Taxes		2,028.00
Total cost of production		$ 88,087.74
Total gross earnings above		$135,626.60
Total cost of production		88,087.74
Net earnings carried to surplus		$ 47,538.86

Cash Balance.

Receipts—		
Cash in office of plant July 1, 1912	$ 616.53	
Collected from private consumers	105,033.82	
From wiring permits	944.00	
From deposits	1,498.00	
Fire alarm department	1,995.93	
Electroliers (City of Alameda)	10,656.74	
A. Webb	10.00	$120,745.02
Disbursements—		
Deposited with city treasurer	$119,635.49	
Deposits returned	373.00	
Cash returned to consumers	7.60	
Wiring permits cancelled	4.00	
Cash in office of plant July 1, 1913	724.93	$120,745.02

Balance Sheets.

		June 30th.	
Assets—	1913.	1912.	1911.
Plant	$360,099.29	$270,393.76	$275,726.38
Supplies on hand	2,163.33	2,524.33	1,395.07
Insurance paid in advance	373.06	1,198.90	1,508.00
Suspense	5,564.65	....	....
City Treasurer	29,453.56	18,900.49	5,814.98
Mun. Imp. Fund No. 10	67,226.54	....	....
Cash in office	724.93	616.53	360.33
Private consumers owe	9,451.50	8,557.50	8,021.85
Fire alarm department	100.00	1,055.01	1,643.49
Waterside Terrace Tract	149.34	....	....
City of Alameda	35,738.74	....	....
	$511,044.94	$303,246.52	$294,470.10

		June 30th.	
Liabilities—	1913.	1912.	1911.
City of Alameda	$..........	$ 38,131.67	$ 73,287.25
Bondholders No. 8	43,750.00	....	....
Bondholders No. 10	150,000.00	....	....
Sundry creditors	8,065.19	8,548.96	10,181.97
Deposits to be returned	1,884.00	759.00	667.50
Surplus	307,345.94	255,806.89	210,333.38
	$511,044.94	$303,246.52	$294,470.10

Comparison of Cash Expenditures for Operation.

	Year to June 30, 1913.	Year to June 30, 1912.	Year to June 30, 1911.
Production Expense—			
Salaries and wages	$13,793.90	$11,622.70	$10,741.30
Maintenance of buildings	....	47.36	78.31
Maintenance of mach & tools	2,439.74	2,564.04	1,993.44
Fuel	17,796.60	15,399.60	21,831.40
Lubrication	550.25	409.64	642.46
Tests for foundation	704.30	....	....
Other production expense	486.92	203.77	194.19
	$35,771.71	$30,347.11	$35,481.10
Distribution Expense—			
Salaries and wages	$13,790.80	$12,505.86	$ 9,670.72
Maintenance of lines	1,164.16	1,975.26	1,733.21
Maintenance of street lamps	4,799.72	3,082.09	2,553.28
Maintenance of line tools	110.19	273.50	32.53
Maintenance of automobiles	1,188.50	....	....
Other distribution expense	1,439.14	1,639.85	961.28
	$22,492.51	$19,476.56	$14,951.02
General Expense—			
Salaries and wages	$ 5,932.40	$ 4,907.70	$ 4,163.80
Stationery and printing	986.69	755.06	603.36
Other general expense	202.98	173.82	146.69
	$ 7,122.07	$ 5,836.58	$ 4,913.85

Comparative Statement of Earnings.

	Year to Jun. 30, 1913.	Year to Jun. 30, 1912.	Year to Jun. 30, 1911.
City arcs	$ 4,196.52	$ 13,904.00	$ 17,076.00
City incandescents	29,511.28	18,003.72	15,700.25
Commercial lighting	84,939.45	80,842.50	73,381.20
Commercial power	14,615.85	12,893.35	11,540.20
Wiring permits	940.00	892.00	778.00
Miscellaneous earnings, labor, supplies, etc.	3,899.10	2,714.30	3,459.57
	$138,102.20	$129,249.87	$121,935.22

Comparative Statement Miscellaneous.

	Year to June 30, 1913.	Year to June 30, 1912.	Year to June 30, 1911
Electrical Output kw.-hr.	3,611,555	3,201,724	2,858,291
Fuel oil consumed, bbl.	29,661	25,766	25,811
Kw.-hr. generated per bbl.	121.8	124.3	110.8
Street lamps burned hours	3,526	3,487	3,486
Consumers gained	501	578	342
Total number of consumers	4,308	3,807	3,229
Cash cost of production on basis of kw.-hr. generated	.994	.945	1.24

Comparison of Expenditures for Construction.

	Year to June 30, 1913.	Year to June 30, 1912.	Year to June 30, 1911
Land	$ 1,875.00	....	....
Buildings	25,800.71	....	....
Steam plant	51,189.04	16.67	21,713.38
Electric plant	10,953.15	....	260.28
Wharf and pipe line	417.04	....	....
Shop tools	635.02	402.13	445.29
Wire	3,148.93	5,174.93	10,421.74
Pole and attachments	1,710.31	3,853.89	6,064.19
Arc lamps	....	25.24	504.20
Transformers	4,400.94	2,963.63	4,258.70
Meters	5,363.66	6,144.07	4,820.27
Services	1,965.37	1,901.12	1,695.77
Automobiles	6,041.51	....	....
Horses and wagons	....	....	265.00
Other distribution plant	....	6.25	64.30
Office furniture	315.80	16.55	....
	$113,816.48	$ 20,504.48	$ 50,513.12

Plant Accounts, Debits.

Plant July 1, 1909	$213,093.48
Additions during year to June 30, 1910	25,310.32
Additions during year to June 30, 1911	50,513.12
Additions during year to June 30, 1912	20,504.48
Additions during year to June 30, 1913	113,816.48
Total amount charged to plant	$423,237.88

Contra.

Amount deducted for depreciation for year ending June 30, 1910	$ 8,379.00
Amount deducted for depreciation for year ending June 30, 1911	9,260.04
Amount deducted for depreciation for year ending June 30, 1912	17,388.60
Amount deducted account special depreciation on arc lamps (obsolete) year ending june 30, 1912	4,000.00
Amount deducted for depreciation for year ending June 30, 1913	16,819.20
Amount deducted account special depreciation on arc lamps (obsolete) year ending June 30, 1913	2,000.00
Amount deducted account of buildings torn down to adjust book account—year ending June 30, 1913	4,000.00
Amount deducted account of horses and wagons to adjust book account—year ending June 30, 1913	750.00
Amount deducted account of sale of horses and wagons—year ending June 30, 1913	541.75
Total amount deducted	$ 63,138.59
Balance present plant June 30, 1913	$360,099.29

Electrical Output Kilowatt Hours.

	Year to June 30, 1913.	Year to June 30, 1912.	Year to June 30, 1911.
July	239,707	209,795	182,008
August	268,429	238,050	206,860
September	269,256	250,825	221,117
October	326,148	289,602	258,004
November	348,056	302,212	267,830
December	377,321	323,684	296,222
January	356,505	318,304	290,123
February	272,676	278,233	239,365
March	314,260	275,099	246,237
April	289,839	253,681	222,244
May	284,387	238,141	227,522
June	264,971	224,098	200,759
	3,611,555	3,201,724	2,858,291

Fuel Oil Consumed, Barrels

	Year to June 30, 1913.	Year to June 30, 1912.	Year to June 30, 1911.
July	1,992	1,886	1,967
August	2,106	1,945	2,024
September	2,061	2,042	2,005
October	2,759	2,244	2,388
November	2,621	2,292	2,439
December	2,890	2,476	2,512
January	2,803	2,439	2,527
February	2,272	2,165	2,135
March	2,460	2,138	2,269
April	2,592	2,171	1,849
May	2,676	2,058	1,877
June	2,429	910	1,819
	29,661	25,766	25,811

Prices Paid for Fuel Oil.

July 1, 1909 to Feb. 1, 1910	$1.08 per bbl.
Feb. 1, 1910 to Feb. 19, 1911	1.00 per bbl.
Feb. 1, 1911 to July 1, 1913	.60 per bbl.

Current Generated per Barrel of Oil Kilowatt Hours.

	Year to June 30, 1913.	Year to June 30, 1912.	Year to June 30, 1911.
July	120.3	111.2	92.5
August	127.5	122.4	102.2
September	130.64	122.8	110.3
October	118.2	129.1	108.0
November	132.8	131.9	109.4
December	130.6	130.8	117.9
January	127.19	130.5	114.8
February	120.	128.5	112.1
March	127.7	128.7	108.5
April	111.8	121.5	120.2
May	106.3	115.7	121.2
June	109.1	117.3	110.4
Average for year	121.8	124.3	110.8

City Lighting—Number of Hours Street Lights Burned.

	Year to June 30, 1913.	Year to June 30, 1912.	Year to June 30, 1911.
July	240	225	224
August	256	269	255
September	276	279	284
October	311	329	328
November	348	349	346
December	379	370	376
January	369	356	374
February	299	305	293
March	332	297	299
April	262	259	254
May	240	233	238
June	214	216	215
	3,526	3,487	3,486

Current Output and Sales.

	Kw.-hr.	Kw.-hr.
Generated		3,611,555
Sold private lighting	1,215,244	
Sold private power	374,676	
Used by City of Alameda street lighting and light in public buildings (estimated)	1,080,916	
Used at electric plant	202,288	
Total accounted for		2,873,124
Loss in distribution		738,431
Loss in distribution, 20.4 per cent		
Loss in distribution 23.8 per cent, 1912		

Average Price Received Per Kw.-hr.

	This Year.	Last Year.
Private lighting	.0699	.0716
Private power	.0390	.0389
City lighting	.0312	.0372

Plant Accounts June 30, 1913.

Land	$ 4,875.00
Buildings	26,364.03
Steam plant	123,440.37
Electric plant	24,507.74
Well	611.00
Wharf and pipe line	417.04
Shop tools	1,735.18
Other prod. plant	353.16
Wire	62,801.31
Poles	21,866.95
Arc lamps	457.84
Incandescent apparatus	208.64
Transformers	24,051.86
Meters	43,343.34
Services	16,931.11
Automobiles	5,925.36
Line tools	394.68
Other dist. plant	546.06
Office furniture	1,268.62
Total	$360,099.29

Office of City Auditor.

The books of this office show that for the fiscal year ending June 30, 1913, the receipts and disbursements for the Municipal Electric Light Plant, have been as follows:

Electric Light Fund.

Balance: Cash on hand July 1, 1912	$ 18,900.49
Receipts from Sundry Sources	118,604.59
Total	$137,505.08
Total warrants allowed	109,201.52
Balance: Cash on hand July 1, 1913	28,303.56
Waterside Terrace Tract deposit	1,150.00
	$ 29,453.56

Municipal Improvement Fund No. 10—Electric.

Received from sale of bonds authorized April 12	$150,000.00
Total warrants allowed	82,773.46
Balance. Cash on hand July 1, 1913	$ 67,226.54

Fire Alarm Department—Expenditures.

Labor	$ 633.00
Fire Alarm Box	125.00
Supplies	272.92
Total	$1,030.92

Alameda is admitted to be the best lighted residence city in the United States. There are 4118-60 watt Mazda lamps on iron standards, placed 150 ft. apart, on each side of the street, staggered so that there is a lamp every 75 ft. The lamp post is

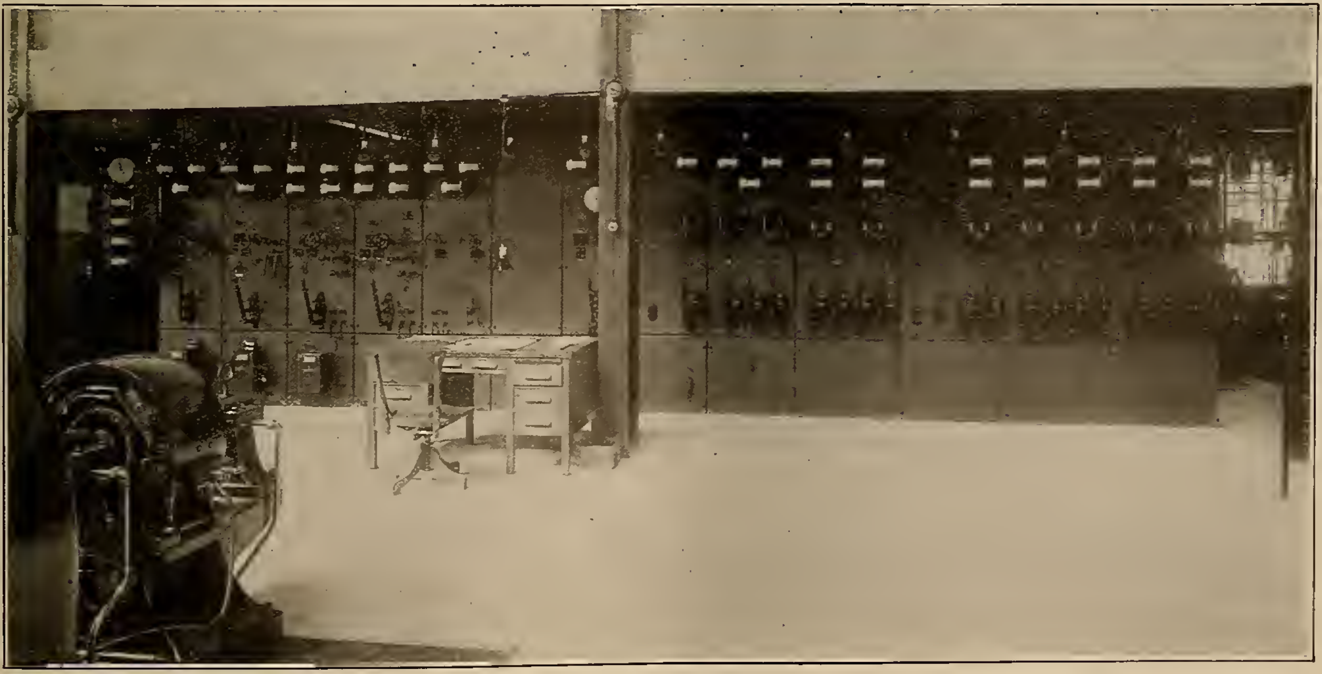
Alameda System of Street Lighting for Tree-Planted Streets.

of local design, and of a construction that is both simple and durable. It was recognized that for tree-planted residence streets it was necessary to so install the lamps that the maximum of street and sidewalk illumination would be secured without the foliage interfering to an appreciable extent and small units plentiful in number were considered as best to secure this result. An ordinance was passed which provides that all trees be trimmed 9 ft. above the curb so as not to interfere with the street lighting. It will be noticed from the illustration that the posts are lower than usual for that purpose. The effect is excellent. All wire and conduit for the street light system is underground and controlled from the plant.

The department of electricity also operates a store located in the business district for the sale of lamps and electrical appliances. The appliances are sold to consumers at a low price for the purpose of encouraging patrons of the plant in the further use of electrical current. Lamps are also handled so as to guarantee to customers a good lamp of proper voltage and at a reasonable price. The office staff and accounting department occupy commodious quarters in the city hall where all accounts and monthly statements of the operation of the plant are on file for inspection and examination by citizens and others interested. There is an ordinance governing the inspection of all electric wiring installed in the city, and all persons engaged in the business are required to pay a license fee and to register. The department has an inspection bureau, as the enforcement of this ordinance comes within its jurisdiction. The inspection is rigid, and insures the property owner against losses which might result through faulty work performed by unscrupulous wiring contractors.

The Alameda Municipal Electric Light Plant is under the control of a board of three commissioners of the Department of Electricity of the City of Alameda. The commissioners are appointed and receive no salary, but give their services as a duty of citizenship and a matter of civic pride.

The success of the Alameda Municipal Electric Light Plant is undoubtedly due to the advantage of having on the board of commissioners men who are by education and experience fully qualified for the work. The success of municipally owned public utilities hinges upon their being conducted along the same



The New Switchboard.

Street Lighting-Regulators.

lines as those of private ownership. Politics have no place in the operation of the Alameda Department of Electricity. Men are employed and retained on their merit, the superintendent of the department having entire charge of the hiring and discharge of all employees and highly efficient service is secured.

The plant is situated in an ideal location on the shore of San Francisco bay. There is a steadily increasing demand for power along the tidal canal and this is rapidly building up the day load. The increased demand for electrical appliances has also an important bearing upon increased consumption of current during the day time.

The power factor of the system during the evening load is 95 per cent, but in the day-time it drops to 72 per cent. The load factor is above 30 per cent and this is probably due to the large proportion of residence lighting business.

The overhead construction complies with the state law governing the same. All poles are 45 ft. long, 8 in. top diameter, round, and of cedar. There is an agreement with the telephone company by which the joint ownership of poles allows both companies to use them, thus reducing as far as practicable the number of poles upon the streets.

The population of the city is approximately 30,-000 and there are over 4000 meters installed. All service rendered and current sold, is charged for, including street lighting and public buildings.

Although all city lighting is charged at 2¼c per kw.-hr., the city is really getting its street lighting and more for nothing, as all profits from the operation of the plant are returned to the city treasury. No provision is therefore made for taxes for street and public building lighting purposes.

The department also has charge of the fire alarm system and the same men take care of it that are in the lighting plant service, which reduces the cost of maintenance to a minimum. A contract has just been let for the installation of a police flash-light system, with the Gamewell Fire Alarm Company, and this system will also be under the charge of the department of electricity. The cost of maintenance for these two systems is paid for by the police and fire departments.

Irrigation by Electric Power.—The Western States Gas and Electric Company, a Byllesby property, first made efforts to develop the use of electric power for irrigation purposes in the territory north of Stockton in February, 1912. In October, 1913, the company had connected 4652 h.p., in motors, all used for pumping water in the irrigated districts, the water being obtained from 30 to 50 ft. wells. By irrigating already fertile San Joaquin lands in this way, their productiveness is greatly increased. Samuel Kahn, general manager of the Stockton property, says: "We receive daily applications for electric power in the rural districts which come totally unsolicited, for every farmer who has power on his ranch acts as a new business agent for our company. The real estate companies which are subdividing tracts of land act as power salesmen for us also. I have in mind a firm which at the present time is selling 5 and 10 acre ranches, and with each ranch they give the purchaser a motor and a pump, and at the same time have him sign an application for power, which is mailed to us."

A NEW RATE MAKING BASIS.

BY MAX THELEN.

(In the absence of a definite Supreme Court decision as to the basis upon which public utility rates should be established the author argues in favor of a just and scientific method of making public utility rates with particular attention to land values. As part of a paper read before the annual convention of the National Association of Railway Commissioners at Washington, D. C., in October, 1913, this argument was preceded by citation of several cases showing the great difference between the "cost of reproduction" and "original cost" due to the unearned increment of land. The author is commissioner and attorney for the Railroad Commission of the State of California and his statements are worthy of the most careful consideration.—The Editor.)

The fundamental relationship existing between the public and its public utilities is that of principal and agent. Out of this relationship logically should grow the proper basis for determining the rates which a public utility is entitled to charge. The state has the right to do for the public whatever is demanded for the public welfare, including the establishment and operation of enterprises of a public utility character. What the state can do itself it has the right to delegate to private corporations and persons to do for it.

In carrying out the agency, the public has given to the public utilities the right to use the streets and highways and to take the property of private persons in the exercise of the power of eminent domain. These are tremendous powers which are conferred by the state only upon its agents in the prosecution of enterprises of a public or quasi-public character. In eminent domain proceedings the plaintiff must allege and prove that the use is a public use and that the plaintiff is in charge thereof. He can be in charge thereof only as the agent of the public to carry out powers exercised in behalf of the public as principal.

Now with regard to the bearing of this relationship on the problem of the proper basis for rate fixing. It is a well established principle in agency that an agent acting within the scope of his authority is entitled to be reimbursed for the money which he honestly and judiciously expends for the benefit and account of the principal, together with a proper compensation for his services. As a general rule, it is a breach of good faith and of loyalty to the principal for an agent to deal with the subject matter of the agency so as to make a profit out of it for himself in excess of his lawful compensation. If such profit is made, the agent may be held as a trustee and may be compelled to account to his principal for all profits and advantages acquired by him out of the relationship. If the agent acquires title to property in his own name as part of the agency, he will be deemed to hold this title for his principal. If A is the principal and B the agent, and A, for the purpose of enabling B to carry out the agency, deeds property to B, B cannot later contend that he can hold the property for himself. He holds it for his principal. Likewise, if B, in the course of his agency, acquires title to property from any source, and that property thereafter increases in value, he cannot lay claim to keep the increase for himself. In each of the above cases the agent holds the property for the principal and must account to the principal for it.

Applying these principles to the relationship between the public and the public utilities, it seems clear that the public utilities are entitled to a reasonable return upon such money as they honestly and wisely expend for the public, but that they should not be allowed a return on the increased value of the property used in the agency. If the agent has expended money dishonestly or has expended it injudiciously, he is not entitled to a return thereon. On the other hand, if he has acted honestly and wisely, and it thereafter becomes possible to acquire more cheaply property which he has purchased in the agency or to secure at a lesser expense labor or material used therein, the agent should not be compelled to suffer the loss but should be entitled to a return on the money honestly and wisely spent by him in pursuance of the agency.

This conclusion has been worked out by Justice Van Fleet in the water rate case of the San Diego Land & Town Company vs. National City (174 U. S. 739), logically and on principle from the fundamental relationship existing between the public and its public utilities. The use of the present value or the reproduction value theories does not spring in any way out of that relationship and has no necessary connection with it. As Justice Van Fleet clearly points out, the use of either the present value or the reproduction value theories may be as clearly unjust to the public utilities on the one hand, in case prices have gone down, as it is to the public on the other hand, in case values have gone up. In logic and justice, the public utility should receive a return on the money reasonably and properly expended in the acquisition and construction of its works actually and properly in use to carry out its agency—no more and no less.

A study of the decisions and of the trend of events shows clearly the cause of the adoption of the present value or the reproduction value theories. In the first cases which came before the courts, the utilities claimed a return on the amount of stocks and bonds outstanding or on the original cost, including large expenditures either dishonestly or unwisely incurred. The courts say clearly that it would be unfair to allow a return on such basis, and in looking for a way to avoid the unjust results which would follow therefrom, hit upon the present value and the reproduction value theories. But in doing so, the courts did not see that the application of these theories might with increasing values, particularly of land, result in an injustice to the public just as great as the injustice which would ensue in many cases if the amount of outstanding securities were used as the basis or if the original costs, swollen by dishonest or injudicious expenditures, were used. In seeking to avoid Scylla many of our courts have rushed into Charybdis. The time has come for a return to first principles.

Franklin K. Lane, whose ability on the Interstate Commerce Commission marks him as one of the great constructive statesmen of the age, clearly saw the danger which now confronts us.

In the Western Advance Rate Case (20 Interstate Commerce Commission Reports, 307), Mr. Commissioner Lane reaches the following conclusion as to the proper basis of fixing rates, with which conclusion I am heartily in accord:

> The trend of the highest judicial opinion would indicate that we should accept neither the cost of reproduction, upon which the Burlington's estimate of value is made, nor the

capitalization which the Santa Fe accepts as approximate value, nor the prices of stocks and bonds in the market, nor yet the original investment alone, as the test of present value for purposes of rate regulation. Perhaps the nearest approximation to the fair standard is that of bona fide investment—the sacrifice made by the owners of the property—considering as part of the investment any shortage of return that there may be in the early years of the enterprise. Upon this, taking the life history of the road through a number of years, its promoters are entitled to a reasonable return. This, however, manifestly is limited; for a return should not be given upon wastefulness, mismanagement or poor judgment, and always there is present the restriction that no more than a reasonable rate shall be charged.

Mr. Lane's conclusion is based upon the fundamental relationship between the public and the utilities, it is accurate in theory; and it is just both to the utilities and to the public. In my opinion, it furnishes the best single basis for fixing rates and the basis to which attention should primarily be directed whenever the facts can be ascertained. Of course there will be cases in which modifications of this basis will have to be made. I am only seeking to ascertain the proper basis to use as a starting point in rate fixing inquiries.

Refutation of Objections.

It has been said that original cost, including betterments and additions, should not be used as a basis for utility rates, for the reason that it is often difficult to ascertain original cost. This objection goes not to the correctness of the principle but to the difficulty of applying it in a given case. It is true that in the eastern, and to some extent the middle western sections of this country, it is often impossible to ascertain the original cost of public utilities. In such case the courts and commissions should strive to ascertain as nearly as they can what the original cost reasonably should have been. A number of commissions in applying the reproduction test ascertain as nearly as possible what the work reasonably should have cost under the conditions under which it was actually performed. This test is practically the same as the test herein advocated. If it is impossible to ascertain the unit price and the conditions under which the work was originally performed, it may become necessary to ascertain reproduction value less depreciation as of the time when the rate inquiry is held. In doing so, it should be clearly borne in mind that this is being done not because reproduction less depreciation is the proper ultimate basis, but because it furnishes in the particular case the best available evidence of what the original cost reasonably should have been. If we bear this fact clearly in mind, we shall not rush into the dangers which ensue from the use of the present value or reproduction value test, without clearly understanding its significance. In California, the railroad commission has ascertained the original cost of right-of-way and terminal grounds of a considerable number of railroads, including all the land of the Western Pacific Railway. In other western and middle western states it will be possible to a considerable extent to ascertain the original cost, particularly of land.

It has frequently been urged that a public utility is entitled to a return upon the present value of its property or upon the reproduction value thereof, for the reason that it has title to the property, and it has been argued that a failure to give to a public utility a reasonable return upon the property to which it has title would be to confiscate its property in violation of the 14th Amendment to the Federal Constitution. This conclusion overlooks the relationship between the public and the utility and is based on the erroneous assumption that title is the basis of a fair return in public utility cases.

Referring to the first point, the Supreme Court, beginning with Mr. Justice Harlon, in the case of Smyth vs. Ames, has held that a utility is entitled to a return upon the fair value of the property, considering, however, all the circumstances. The most fundamental of these circumstances is the agency relation existing between the public and the utility. The utility takes its property subject to that relationship and can no more urge the plea of confiscation than can any other agent who acquires his property in the course of the agency and who is accountable to his principal for it. It would be just as logical for an agent who has acquired title to a piece of land in the course of his agency to claim confiscation if he is not allowed to keep the unearned increment for himself as it is for a public utility to make the same plea with reference to the property which it holds in its capacity as agent.

Referring now to the argument that title is the determining factor in ascertaining the proper basis for rates, it is evident that this view is erroneous. A public utility may, in the pursuit of its agency, spend large sums of money properly chargeable to capital account and entitled to be considered in rate fixing inquiries, and yet the utility may not secure title to the property represented by that money. For instance, a railway company may be put to considerable expense in paving streets, the title to which is in the public. Again, the company may build expensive structures in the public streets and may incur large expenditures for grade separations in the public streets. That the company is entitled to a return on the money so expended, even though it does not have title to the property acquired thereby, must be admitted by every fair-minded person. If it is just that the utility should be allowed a return in certain cases on money expended on property to which the utility does not secure title, it seems equally just that it should not be allowed a return on property to which it does have title, in excess of the amount to which, under its agency relation, it is fairly entitled. This thought is expressed by Whitton in Section 192 of his valuable work on "Valuation of Public Service Corporations," as follows:

> Similarly if the government has given this same company the land for its right-of-way, the actual property in which the company has invested its capital and not that part to which it has title but which has been donated by the government should be considered in determining reasonable rates. Actual title and possession are not always conclusive. The determination of a reasonable rate is an equitable process and equity will demand that certain property to which the public has title should be included and certain other property to which the company has title should be excluded. It is the actual investment or sacrifice on the part of the company that is entitled to consideration regardless of mere title or possession.

The reason why a private citizen buying land is entitled to the unearned increment while a public utility acquiring land is not so entitled is that the citizen is performing no function of government and is not acting as an agent of the government, while the utility owes its entire existence and right to operate to the action of the state in conferring upon it certain of the powers of government, such as the right to use the streets and to take private property, to be used in the pursuance of its agency. The two cases are entirely different. To reach a conclusion in the one by an analogy to the other is extremely dangerous.

Commissioner Maltbie of the New York Public Service Commission of the First District, has clearly seen the difficulties arising out of appreciation of values and has tried to avert the danger by considering appreciation in value as income and balancing it against depreciation in other kinds of property. However meritorious this theory may be, the Appellate Division of the Supreme Court of New York, in the case of People ex rel. Kings County Lighting Company vs. Willcox, decided on May 9, 1913, refuses to adopt this view. While it seems clear that the result which Commissioner Maltbie desires to ascertain is correct, and that his theory, if adopted, would reach that result, I am of the opinion that the same result would be obtained more logically by starting with the basis herein explained than by starting with the cost of reproduction less depreciation basis. It seems to me wiser to return to first principles and to adopt a basis which springs logically and justly out of the fundamental relationship between the public and public utilities. If the courts fail to adopt this view, Commissioner Maltbie's theory appears to offer the only remaining hope.

In view of the tremendous importance of the problem and the uncertainty as to its ultimate solution, the policy to be pursued in the meantime by the various state railroad and public service commissions becomes a matter of serious consideration. I would suggest that in making physical valuations of utility properties and making their findings thereon, the commissions confine themselves to findings on questions of fact, and refrain wherever possible from finding as to the ultimate question of value. This is the policy pursued by the California Commission. The commission makes its findings on certain questions of fact, including the facts with reference to the organization and operation of the railroad, its stocks and bonds, its revenues and expenses, its original book cost, its reproduction value and its present value, by which latter term is not meant the ultimate fact of present value, but what may be termed the reproduction value less depreciation. The commission accumulates all these facts and makes its findings on them, but refuses to make a finding on the ultimate question of the value of the property. The value may be one sum for one purpose and another sum for another purpose. The correct value depends fundamentally both on the purpose for which it is to be ascertained and on the correct principle to be adopted in ascertaining it. Until the Supreme Court of the United States has clearly and unequivocally established the principle which it considers correct after its attention has been squarely drawn to the tremendous importance of the question of appreciation in value, I believe it would be far wiser for the commissions to adopt the policy which the California commission is at the present time pursuing. Whenever the correct principle is definitely established, it will be possible to refer to the findings of the commissions on the various branches of the question and from these findings to determine the ultimate fact of the value which is to be assigned to the property for rate making purposes. By exercising care with reference to these facts, and distinguishing clearly between a fact and a conclusion therefrom, the commissions will avoid the danger of putting themselves in a position from which they cannot withdraw and of adopting theories and making findings which will later come back to plague them.

I accordingly suggest that the various state commissions do all in their power to draw the attention of the courts to the dangers which confront them and to secure, if possible, the establishment of the principle herein contended for, which principle I believe to be correct in logic and in justice, and that in the meantime the commissions so do their work that they do not commit themselves in a way which will work increasing injustice to the public throughout the generations which are to come.

LETTER TO THE EDITOR.

(The letter reproduced herewith shows where one of our recent editorials struck a responsive chord in the East. The comment is appreciated. The name of Mr. V. R. Lansingh needs no introduction in the West. His book on "Practical Illumination" is read with profit by all interested in that subject. In connection with his efforts to better illumination and on account of the remarkable educational campaign carried on by the Holophane Company of which Mr. Lansingh is general manager, knowledge of his name and work is nation wide. Sufficient encouragement has been given us to assure the formation of at least one Section in the West.—The Editor.)

Cleveland, Ohio.

Dear Sir: I have been much interested in reading your editorial on the Illuminating Engineering Society in your issue of November 1, 1913. I was especially interested inasmuch as some years ago, as chairman of the New Sections Committee, I attempted to form a local section in San Francisco and also one in Los Angeles. One or two meetings of prominent engineers in these cities were held and the situation was thoroughly discussed. While the sentiment, as a whole, was in favor of forming such sections, it seemed unwise at that time to really start them until the propaganda of good illumination had spread somewhat further. I therefore was more than pleased with your editorial on this subject. Although I am not now chairman of the New Sections' Committee, I am going to take the liberty of calling your editorial to the attention of our president—Mr. C. O. Bond.

If, as the result of your editorial, you receive comments or letters on the subject, I am sure the Society would be most pleased to hear from you either one way or the other.

Very truly yours,

(Signed) V. R. LANSINGH,

Chairman Committee on Sustaining Membership,
Illuminating Engineering Society.

HYDRAULICS V.

BY OTTO B. GOLDMAN

Irrigation System.

This subject naturally covers the design of (a) the pumping station, (b) the delivery and accessories and (c) the distribution of the water over the land being irrigated. In some cases "gravity" water is available. Whether to utilize this or obtain the water by pumping, is simply a matter of relative costs. If the interest on the difference in cost between a gravity system and a pumping system is equal to or greater than the cost of power, then the latter system is preferable. The maintenance of a long canal, is much greater than a first class pumping plant. A long canal is a rather vulnerable piece of work, usually requiring much expensive repair work each spring. A gravity system, however, often tends to increase the number of pumping plants in a district, because there is usually more land above than below a ditch.

The O. W. Porter Pumping Plant in Eastern Oregon.

The source of water for most pumping plants of average or large capacity, is a stream. The best practice usually is to construct an intake at right angles to the stream, terminating in a sump, from which the water is pumped. The intake should be of large enough submerged section at extreme low water, to permit of the maximum inflow required, without appreciable loss of head. The sump must also be of sufficient depth to permit of the proper depth of submergence of the ends of the suction pipes, otherwise vortices will be formed, permitting air to be taken into the pumps. This will cause them to stop pumping altogether or worse still, permit them to continue at greatly reduced capacities and efficiencies.

Both the intake and sump should be lined sides and bottom with concrete to prevent erosion. The former should also be supplied with removable trash rack, and coarse and fine screens, placed in the order named from the stream. It is certainly not good practice to depend on a miniature screen fastened on the end of the suction pipe. The illustration of the Jason Halleck plant and still better the O. W. Porter plant show proper intake construction. Both plants are pumping from the Snake River near Weiser, Idaho.

It is perhaps needless to point out, that all machinery should be placed on concrete foundations. These should be of sufficient depth to prevent displacement, and of sufficient weight to absorb all vibrations. This holds just as true for small, as for large plants.

The Jason Hallack Plant Near Weiser, Idaho.

The housing for the machinery should be of fireproof construction. To put expensive machinery, upon which the entire crops of the land being served depends into a fire trap is bad practice and is being discarded. This type of construction is illustrated by the half-tone of the Sunnyside Orchard Company's plant and of the Weiser Flat Pipe Line Company's plant.

The Sunnyside Orchard Company's Plant.

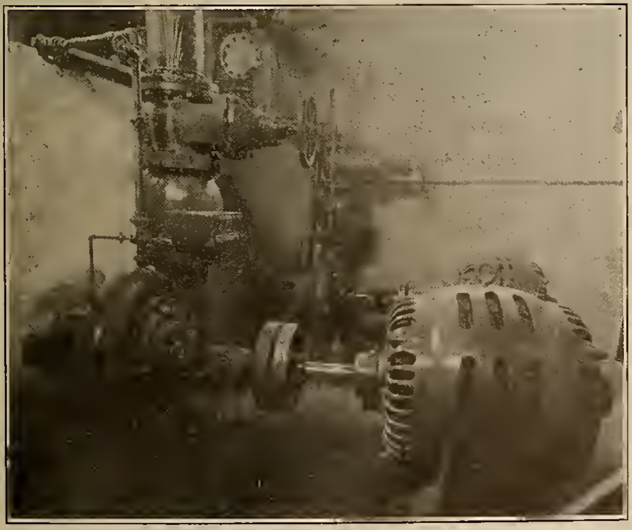
The building should be well supplied with windows, not only for light, but for ventilation. Whatever the motive power, a certain amount of heat is always liberated, which must be carried away, especially during the summer. This can easily be done where windows can be opened on opposite sides of the building and in the general direction of the prevailing air current. The latter two figures again illustrate building construction with improper ventilation

while that of the Porter plant, that of perfect ventilation.

In the very great majority of plants, electricity is employed as the motive power. This is not only due to the greater simplicity and ease of operation of a motor, but because the latter can be direct-connected

Exterior of the Weiser Flat Pipe Line Company, Weiser, Idaho.

to the pumps, at comparatively small additional cost and really at a saving, when we take into consideration the cost of the building, because of the much smaller building required by direct-connected units as compared with belt-driven outfits. This is well shown by the accompanying illustration. The Crystal District plant in Oregon and that of the splendid Snow-Moody near Payette, Idaho, both show the compactness of direct connected units. From the interior of the Weiser Flat Pipe Line Company's Plant before



Crystal District Plant in Eastern Oregon.

it was remodeled the large floor space required by these units should be noted as well as the poor ventilation provided. In the new plant, this has been changed and the pumps direct connected. An additional unit has also been provided. Practically all irrigation pumps are of the centrifugal or turbine type, because of their simplicity and long life. They have very few moving parts. A well-constructed pump of this type will maintain nearly its initial efficiency after many years of hard service. Relative to the choice of the pump, it must be remembered that this is one of the smallest items of cost in an irrigation system, but the most important, upon its efficiency and continuity of operation depends the success of the entire system. A cheap pump represents no more of an investment than a bet at the race track. Not only should we look to the guarantee of initial efficiency, but should also note whether the construction is such that this efficiency can be reasonably well maintained:

The Snow Moody Plant at Payette, Idaho.

whether it is such as to insure continuity of operation and whether the pump has desirable operating characteristics.

The most important parts of good pump construction are:

(1) The use of the enclosed runner, hydraulically balanced against end thrust;

Interior of the Weiser Flat Pipe Line Company's Plant Before Remodeling.

(2) Bearings on both sided of the runner, instead of having this overhung.

(3) Accessibility to the runner without disturbing suction or discharge piping;

(4) The use of the non-overloading type runner in direct-connected units;

(5) The use of water-sealed stuffing glands;

(6) Bearings of the external, ring oiling type;

(7) The use of flexible coupling between motor and pump in direct connected units.

The second and third parts of this general subject will be taken up in a further article.

THE BROADWAY BRIDGE, PORTLAND, ORE.

BY F. D. WEBER.

Construction.

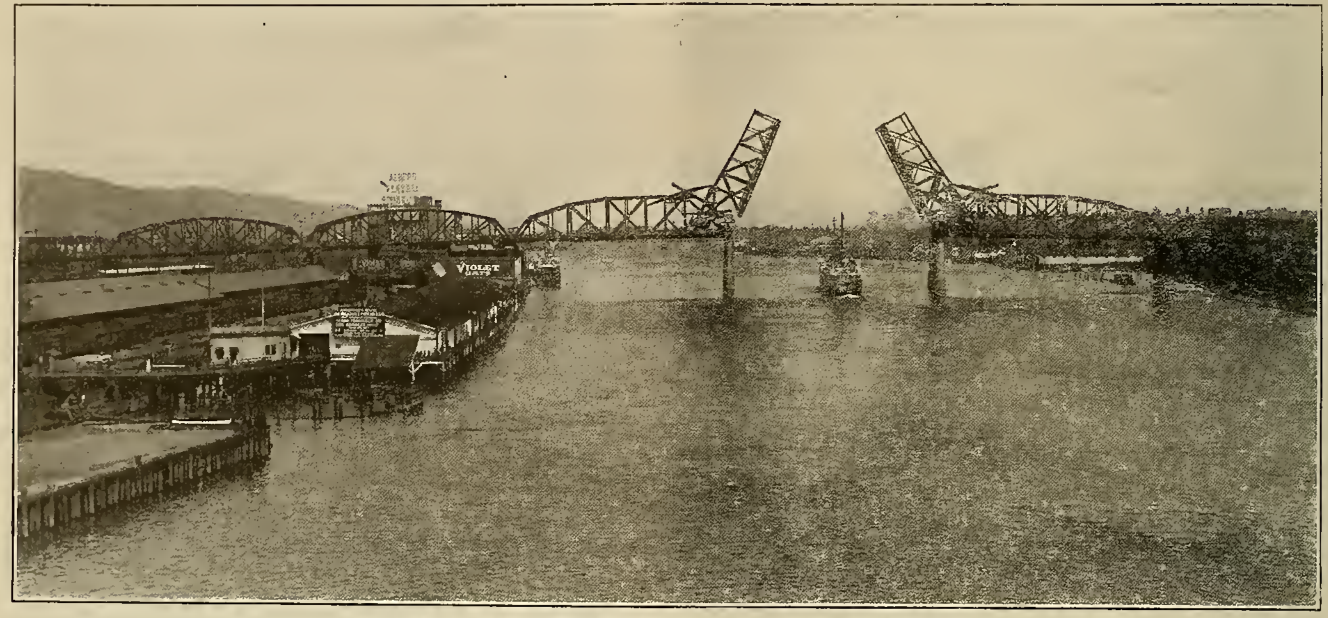
There is now in successful operation in Portland, Ore., the largest "Rall Bascule Span" ever erected, and the details of the general construction and equipment should prove of considerable interest. This bridge cost $1,600,000, and its estimated life is 100 years. The length, from the west approach to the east, is 2150 ft. There was used 7800 ton of steel in its construction, and the height above low water is 92 ft. The height of the bascule leafs, above bridge deck, when raised, is 175 ft. The width of bascule leafs is 250 ft. in the clear. The grade of the west approach is 3.8, and that of the anchor spans and base 2.25. The width of the roadway is 46.5 ft. and over all 70 ft. The counter weights contain 570 yd. of concrete in each, there being two in number, one for each leaf, and each leaf contains 950 ton of steel. The decking is paved with creosoted wood paving blocks, with Schuman pavement on the bascules.

The bascules are operated electrically with 600-volt motors, the energy for which is secured from the Portland Railway, Light and Power Company's street car trolley system. The west bascule can be operated from the west side of the river, the east bascule from the east side of the river, and both bascules from the west side of the river. The two sides of the bridge are connected under the river channel by submarine cables, but are fed from different and independent substations.

The operating equipment was furnished by the General Electric Company. The motor equipment for the east lock consists of one 5 h.p., 400 r.p.m., 600 volt, d.c. series wound motor, with disc brake, and one drum type controller with resistance.

The main motor equipment consists of four 75 h.p., 650 r.p.m., 600 volt, series wound back geared motors, back gear ratio 58/19, each equipped with solenoid brakes and controllers with resistances. Two emergency air brake equipments, each consisting of one air compressor 600 volt. (25 cu. ft. per minute piston displacement.) One MC Form B governor, safety valve and 16x48 in. reservoir. The switchboard was furnished by the Westinghouse Electric & Manufacturing Company.

The weight of the machinery used to operate this bridge is 100 ton. The bascules are each operated by two 75 h.p., 650 r.p.m. series wound back geared motors, each equipped with solenoid brakes. These are directly geared to a shaft to which is attached a large wheel, which in turn engages a straight operating strut with teeth on the under side, and these engage the geared wheel. Consequently the bascule is virtually pulled and pushed up and down on the anchor pier, on which all the machinery is located and properly housed. The bascule rolls on a 100 in. nickel chrome steel roller, 40 in. face. The locks are operated by motors and the brakes by compressed air.



Portland, Oregon, Broadway Bridge—Rall Bascule Open.

The equipment is in duplicate, as regards motor equipment, so that if one motor should burn up there would still be sufficient capacity to operate the leats.

This bridge is of the highest class of workmanship known for highway bridges. It has been built to withstand the heaviest traffic that it could reasonably be expected to carry. The sidewalks, of concrete, are designed to sustain 100 lb. per sq. ft., and two ordinary railroad freight trains could cross it at the same time without straining it in the least, but not the concentrated weight of the heaviest locomotives. The floor and girder spans are designed to bear a load of 51½ ton cars crowded with people on each of its two tracks. The roadway on each side of the tracks are built to carry 24 ton steel or machinery trucks and the remaining surface of the roadway to hold a weight of 100 lb. per sq. ft.

The peculiar feature of the Rall type is the huge steel roller on which the bascule rolls back on the steel track, supported by the anchor span, in opening and closing. This feature made it necessary to design a special method of crossing these bascules with the two trolleys, and this problem was satisfactorily worked out by the Portland Railway, Light and Power Company. In passing, it should be noted that there are

four distinct rotary motions, one about a stationary center, and the others about movable centers.

The City Engineering Department of Portland designed a special trolley pole for use on this bridge, and the only fault that has developed so far, is the fact that they have pulled loose, in two instances, from the bridge decking, but the poles themselves have not failed in any way.

The 600 volt trolley current is used for the signal lights of the bridge and a special resistance is employed with them.

The designing engineer of this bridge was Mr. Ralph Modjeski, consulting engineer, New York.

The Strobel Steel Construction Company of Chicago, Ill., designed all the steel work and the Pennsylvania Steel Company of Steelton, Pa., took care of the erection.

Broadway Bridge—Rall Bascule Closed.

Bridge Lighting.

BY F. H. MURPHY.

The question of suitable bridge lighting has been given considerable attention by the City of Portland, and within the past two years the five steel bridges spanning the Willamette River, as well as a number of smaller bridges in various parts of the city, have been equipped with a system of boulevard post and bracket lighting. Such a system serves its purpose admirably, for not only is it an excellent means for facilitating traffic across the bridges, and a great aid in properly policing them, but it is artistic as well, presenting a very pleasing and attractive appearance either when crossing the bridge or when viewing it from the distance.

In addition to the regular boulevard lighting of these bridges, four of the five crossing the Willamette have been provided with a permanent decorative lighting system also. The one exception is the Harriman double deck bridge, which was completed about two years ago, and the upper deck of which is rented to the city. This, however, has a regular boulevard lighting system for the upper deck, which harmonizes with those installed upon the other bridges. The decorative lighting is used only on special occasions, when the city wishes to celebrate some important event, such as the Rose Festival or a big convention. Since every year brings such events, the inconvenience and expense of installing temporary lights for this purpose became a considerable burden, and it appeared that if lighting of this nature was desirable it would be much better to make it of a permanent nature, thus reducing to a minimum the cost of such decorative advertising, and at the same time having a system available at any time. The result of such a permanent system is far superior to anything that could be produced by loose festoons of light, and so also is the advertising value of such displays. The effect of those thousands of small lamps outlining the principal members of the big steel bridges and transforming the harbor into a beautiful fairyland is magnificent, and it produces a lasting and pleasing impression upon every one who sees it. This, by the way, is good advertising, too.

The last of these bridges to be completed was the Broadway, a magnificent steel bridge with the Rall-Bascule type of draw. This bridge connects Broadway on the east side with the new Broadway (formerly West Seventh street) on the west side. It spans the river with a clearance over the main channel of 85 ft. above high water, and has a draw opening of 278 ft.

In installing the lighting system 19 miles of rubber-covered wire, ranging in size from No. 14, B. & S. gauge to 1,000,000 c.m., were used, 20,000 ft. of galvanized conduit, from ½ in. to 4 in., about 7000 Types RT and RK condulets, 136 2-light brackets, 43 Type B 5 light boulevard posts, 444 100 watt Mazda tungsten lamps, 43 60 watt Mazda tungstens, and about 7000 4 c.p carbon lamps. These figures do not include the navigation and operating lights, which represent a connected load of about 6 kw. The total connected lighting load for the bridge amounts to approximately 200 kw., and the connected power load to about 235 kw.

The service for the bridge is supplied by means of three 50 kw. transformers, one located at the east end of the bridge and the other two on the west side of the river midway between the second and third span of the bridge (numbering from the west end). These transformers are mounted on the bridge structure below the bridge floor, and transform directly from the Portland Railway, Light & Power Company's 10,000 volt lines to a 3-wire, 120/240 volt distribution service. This service in either case passes through an automatic oil switch and into a steel distributing cabinet located above the sidewalk level. The three wire system of distribution is used throughout the installation.

From the cabinet on the west side of the bridge, nine sets of 3-wire feeders are taken. There are four principal feeders, two running east and two running west, one for either side of the bridge in each case, which carry the majority of the post and bracket lights and all of the outline lights for that portion of the bridge west of the center of the draw span. Accompanying each of these feeders is a smaller one which supplies the "Owl" posts and brackets only, and the ninth feeder is carried east to the operating house and supplies the lights for the operating and machine houses as well as the general signal lights and some of the navigation lights. As an emergency precaution these lights are so connected that they may be cut over through a set of resistances on to the 500 volt power service in the event of a breakdown to the regular lighting service.

The feeder system on the East Side is handled in a similar manner.

The "Owl lights" referred to in this article are the posts and bracket groups that burn all night, the

balance of the lighting is cut out at midnight. Every fourth post or bracket group on either side of the bridge was selected for all night burning and these "Owl lights" were so chosen that they are staggered in their relation to each other across the roadway. This gives a very satisfactory and uniform light for the latter part of the night also.

The decorative lighting circuits are controlled by switches in the switch cabinets located beneath the bracket fixture in each case.

The bridge operators' houses are heated by means of electric radiators.

On the west approach, there are thirty-one, type B, 5-light, boulevard posts placed opposite each other and spaced about sixty-five feet part. On the East approach, twelve of the same type of boulevard posts are used and they are located in the same way.

On the bridge itself, 2-light bracket fixtures of a design to harmonize with the boulevard posts are used. These brackets are mounted in pairs upon the principal vertical members of the bridge, one on the roadway and the other on the sidewalk side of the steel member. These groups of four lights are placed opposite each other across the bridge and spaced about fifty feet apart. The distance from the road way to the center of the globes is eleven feet which is the same as the mounting height of the bracket lights on the posts.

All the bracket arms both on the bridge structure and on the boulevard posts are equipped with 100 watt Mazda lamps enclosed in 12 in. C. R. I. globes, and the tops of the posts are equipped with 60 watt Mazdas enclosed in 16 in. C. R. I globes.

In order to reduce to a minimum the effects of bridge vibration, a simple shock absorber was designed and used throughout the installation. This consists of a strip of fibre which is wedged into the iron bell of each bracket arm. To this is attached a coiled brass spring which in turn is soldered to a weatherproof socket. This forms an inexpensive shock absorber which holds the lamp centered in the globe and works equally well under compression or tension.

Provision is made also for protecting the globes against this vibration. A spring brass collar rolled to conform to the curvature of the neck of the globe is used to provide a support all about the globe. At equal distance about this collar, four one-inch lengths of heavy rubber tubing are placed, and these pieces of tubing receive directly the set screws of the post of bracket bells.

The decorative lighting of the bridge is accomplished by means of 4 c.p. carbon lamps spaced 18 in. apart. These lights are distributed along the upper and lower chords and the principal vertical members of the bridge. The line running down each vertical member terminates in a bracket fixture in each case. A new class of condulet, types R J and R K are used throughout the installation for the outline work.

The two sections of the draw span rise through a 90 degree angle and for this reason the bracket lights required special treatment as it was evident that neither the globes nor the lamps could stand the shifting from vertical to horizontal and back again with the resultant vibration due to the operation of the bridge. This difficulty was overcome by a slight change in the design of the 2-arm bracket fixture used throughout the bridge. The usual back plate was omitted and the head of the bracket drilled so as to receive a 1¼ in. pin mounted horizontally upon the vertical member of the bridge on which the bracket would otherwise have been mounted directly. This leaves the bracket unit free to swing through a vertical plane and the center of gravity of the unit is so located that the lights always maintain the same upright position regardless of the position of the draw span. This has proved entirely satisfactory during the five months that the bridge has been in service.

In order that the effects of temperature conditions might be provided for, a number of expansion joints were placed in the long conduit runs. These are especially necessary at the points where the expansion joints for the bridge structure are located and may be very desirable at other places in long runs.

Another problem met and solved in a very satisfactory manner in this case was the matter of carrying the feeders from the anchor spans onto the draw spans. On the other bridges, the connection is made through knife blade or wiping contacts, and as soon as the draw begins to open all the ights on the draw span are extinguished. This is not desirable, or to have the circuit broken so frequently, and furthermore the best of contact switches operating under such conditions are liable to become sources of frequent trouble. It was therefore deemed advisable to use some other means of carrying the feeders on to the draw spans. The feeder conduit on both anchor and draw spans was carried up the bridge structure about twenty-five or thirty feet above the floor of the bridge to points on each span which had the least relative motion with respect to one another and there terminated in iron boxes. A flexible armored cable, carrying three flexible stranded conductors of just sufficient size to meet the Underwriters' requirements for current carrying capacity, is dropped in a long loop from the bottom of one of these boxes to the bottom of the other one. Each feeder is handled in the same manner. Very little relative movement occurs in this cable loop during the operation of the bridge and very little if and trouble is likely to be experienced for years to come.

San Diego's $10,000 electric signboard will be 48 feet high and will be located on the roof of the Josse Building. It will cost $10,000, and is said will be the largest electric sign in Southern California. The sign will contain 32,000 lamps. Across the top in large letters will appear the slogan: "San Diego, First port of Call." The lower half of the sign will be devoted to revolving electric signs of business firms. Current will be furnished by the San Diego Consolidated Gas and Electric Company.

Nearly every residence connected.—Ninety-eight per cent of the residences at Victoria, B. C., are connected up to the lighting company's system. The city has a population of 60,000 and 10,000 lighting meters are in use.

ENGINEERS' CLUB HOUSE WARMING.

Members of the Engineers' Club of San Francisco celebrated their advent into their new club rooms in the Hotel Sutter by a house-warming on Saturday night, November 15th. About one hundred engineers sat down to dinner at 7 p. m. and later enjoyed a humorous take-off on local engineering accomplishments. A full appreciation can be had only by acquaintance with the participants.

The entertainment committee had provided a program along the lines of the famous Gridiron Club of New York. The personnel of the committee, W. W. Briggs as chief instigator ably abetted by Geo. R. Murphy, K. G. Dunn, C. T. Hutchinson and P. R. Bradley, is sufficient evidence of the high grade of fun-making.

A wonderful question box gave the most astounding answers to various propounders. "Who put the bolt in the Jupiter's turbine?" "Jerry done it." "What is a mining engineer?" "A man out of a job." "What is the difference between a telephone engineer and a golf player?" "A. H. Griswold." "What kind of hair does Struble wear on his head?" "A Union Switch." "What is the most interesting surgical operation known to the engineering profession?" "Pierson Roeding." "Who put the gin in engine?" "The bartender."

Briggs, "that notoriously nervy guy," that unveiled the "Farinheight Oxymometer," a weird instrument that the fellow conspirators had designed and carefully calibrated to indicate the height of endeavor reached by the contestants in the bouts that followed.

First was a thrilling drilling contest between two teams of miners. One tipped the scales at 248 lb. bedside, the others being feather weights and perhaps minors. In three minutes the tiny rubber hammers drove the drills through 18¼ and 18½ inches of bruised hands respectively, Judge E. H. Benjamin awarded the potassium permanganate prize to the losers.

Then an investigation of inductive interference was held under the authority of a medical clinic consisting of A. M. Hunt, Frank Varney and E. H. Benjamin, "D.D.S." A. H. Griswold, representing the "Pacific Line out of Order," brought grave charges of interference (which means a striking of the fetlock with the other hoof and is thus a form of kicking) against the Pacific Graft & Easy Mark Co. as represented and ably defended by S. J. Lisberger.

G. A. Williams, "an economic and wasteful geologist," next brought in an oil-well with the assistance of several insulting engineers. The climax was reached when the hole was dynamited and the gusher hit the ceiling.

The entertainment was brought to a close by A. H. Babcock, "the white-hope of the Tehachapi Pass," who again demonstrated why it could not be done.

Engineers' Club Dinner.

The club plans quarterly frivolities of this character which do much to bring the membership into closer contact. The headquarters are now open and latch keys are ready for all members. C. W. Merrill is president and H. F. Bain secretary.

ELECTRICAL COOKING AT VICTORIA, B. C.

Electric cooking is finding much favor among customers and at the present time some 300 installations are in operation, giving entire satisfaction. The B. C. Electric Company gives a special rate of 5c per kw.-hr. for heating and cooking business, subject to a monthly minimum charge of 75c per connected kw.; at this rate there has been no complaint, and this end of the company's business is steadily increasing, the average during the past six months being three ranges per week. One installation, which has proved to be of more than ordinary advertising worth, was a complete electrical installation in one of the local schools, in the Household Science Department. Parents of the girls have an opportunity to visit the classes at any time to note progress made, and the electrical equipment has invariably come in for special attention.

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POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
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CONTENTS

Public Utility Valuation

Public utility valuation is in a chaotic state. The subject is so new that its principles have not yet been definitely formulated. New conditions are constantly arising for which no precedent has been established. Legal decisions lag so far behind engineering progress that many of the underlying theories have not been universally accepted. A new science is in process of evolution.

The most fundamental of these questions, the proper basis upon which rates should be calculated, is now in controversy. Valuation experts may be classified into two schools, those who favor the "original cost" method and those advocating the "present cost," or "reproduction cost" theory. These terms are so nearly self-explanatory as to require no further comment.

Elsewhere in these columns is a strong argument in favor of the former method, it being stated that if the reproduction value theories are carried to their logical conclusion rates will soon become so high that nobody can pay them. The utility corporation is considered as an agent supplying certain needs for the public as a principal. Such agent is entitled to a reasonable return upon money honestly and wisely expended for the principal but should not be allowed a return on the increased value of property used in the agency. Much of the difference between the comparative values reached by these two methods is due to the unearned increment of land worth. The agent has done nothing to earn this increase, consequently the principal should not be asked to pay rates on it.

This view point is in accord with the suggestion which has been previously developed in these pages that the supply of a utility is a public function, not a private business. Its public quality is paramount to private profit. The corporation, as a contractor for the performance of a public service, should place satisfactoriness of service above all else.

Failure to recognize the foregoing facts is the chief reason that many corporations are now being called upon to meet the competition of municipal plants. One of the latter, belonging to Alameda, California, as described in this issue, shows an economy of operation which many a private plant might envy. That more municipal plants do not make similar showings is due only to the inefficiency of political operation. That many privately-operated plants exceed it is an argument in favor of private operation of municipally owned plants. This leasing plan has proven economical and practical in the operation of the Philadelphia gas works after the people became disgusted with political operation, as well as in the Boston and New York subways where the corporation had previously been the party at fault.

Recognition of their public character will do much to protect corporations against competition. It seems to be a consensus of expert opinion that the public is best served by a regulated monopoly. But before the people can be educated to this thought it is necessary for the corporation to show the right spirit. Greed makes a poor creed. The handwriting is on the wall so plainly that he who runs may read.

Business is Good

Views to the contrary notwithstanding, business in the electrical world is good, as shown by the wonderful growth and excellent financial reports. A tacit acquiescence with other's views is often responsible for erroneous conclusions. This is especially true when those views compass either grouch or complaint, and they work havoc to the extent that they are entertained in thought.

Individual action depends upon our opinions hence the importance of forming our own instead of being stampeded through a tacit acceptance of those of others.

We should appreciate the product of our own small plot rather than revel in the weed-choked acres of our neighbors.

Sometimes big business which depends for expensive though necessary extensions upon ability to attract outside capital, feels the pinch because that capital is withheld, but it is only in degree that a lack felt by big business influences business in general.

It would not be reasonable to ignore the world-wide money stringency but in any locality where crops are good and a fair market obtains, where industries are active, or where there is a large influx of better class immigration, that stringency should not exercise a serious influence.

Time was when business was compelled to grow from within and such growth being healthy, the pendulum's swing may yet again find that condition desirable. The use and highest development of that we already have makes possible a natural growth and easy.

Yet business is good. It is unrest occasioned by ill-advised comment and complaint which is undesirable and causes uncertainty. Unrest, it is well to remember is but a negative condition which may be readily dispersed, just as the negative condition of darkness is dispersed at the coming of light. Let us let in the light, flood the country with encouragement, and consign the inelegant grouch to the limbo of our discontent.

One way to undo the effect of unrest and so restore confidence is to be silent about our belief in the bad and boost wherever possible the measure of good which does and always will obtain.

We are ever anxious for improvement. "It might be better," is habitual. The more we have the more we want and soon we find we have more than we want ana either sigh for slack times or focus upon a vacation.

Business is good when we have neither too much nor too little, and he would be indeed a clever judge who could adjust the balance—so let us plow right on though an unceasing pessimism, more or less habitual, predict failure.

It is not customary to make the sale and then advertise, but to advertise that sales may result. Similarly the autumn and winter seasons of business are not those in which we should bestir ourselves because of business gained throughout the past summer, but seasons in which we work preparing the ground for the spring showers and the rich summer harvest.

Let us quit kicking and indulging the inelegant and cultivate instead the inspirational effort back of the slogan "Business is Good!"

Factory Lighting Important

In several western states overtime work in the factory is practically prohibited. But the proper artificial illumination, or factory lighting as it has come to be called, is of as great importance as though such limitations did not exist. In winter-time darkness falls so early that it encroaches upon regular working hours. Night is a trespasser upon the workman's day. Dark corners must be lighted even when daylight is sufficient elsewhere, and again, there are occupations which must be performed at night. The consideration of proper factory lighting cannot be shelved.

In the state of California alone, industrial accidents average over fifty per day and on an average more than one of these results fatally. This includes accidents which occur outside of factories except agricultural. It is estimated that the number of accidents which occur within factories is more than 40 per cent greater during the winter months than the summer. That sufficient, suitable and therefore satisfactory lighting will do much towards decreasing this difference has been amply evidenced in practice. Good lighting is good accident insurance.

Business considerations demand good factory lighting no less than the humanitarian, for with proper lighting it is possible to increase output, improve the grade of the goods manufactured, and decrease the losses occasioned through spoilage. The cost of improved lighting is inconsiderable as compared with these advantages and gains. Improved lighting usually results in economies of current consumption which are astounding.

Change of pace with the waning day was once accepted as but natural. Efficiency of factory operation called for an investigation and it was found that this falling off was due to fatigue. Experiment has proved that the fatigue was due to causes, many of which could be eliminated. One of these was poor lighting and this was one of the easiest and cheapest to remedy for not only were the appliances available, but factory lighting was found to cost but a small fraction of the value of the workman's time. It naturally follows that the employer who fails to provide satisfactory factory lighting is not only guilty of gross negligence in failing to provide known safeguards for reducing the possibility of accident, but is also allowing operating expense leakages which will eventually imperil profits.

Good factory lighting is indeed important.

It should not be necessary to legislate good lighting into our western factories and would not be if we each did our part. A progressiveness in evidence everywhere else here seems temporarily halted. What is the cause? In the electrical business we are apt to agree too readily to instructions given by those who are paying for the work, but who often do not really known what is best for their needs. Here co-operative effort should exist between the electrical contractors and the lighting specialist. To serve the factory and the community in this way is an opportunity which electrical contractors, jobbers, central stations, engineers and lighting experts should certainly grasp.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Wynn Meredith, Pacific Coast engineer with Sanderson & Porter, is at Vancouver, B. C.

A. V. Olson, representing Pass & Seymour, was at Spokane, Wash., during the past week.

R. S. Masson, consulting engineer at Los Angeles, visited San Francisco during the past week.

C. V. Schneider, electrical contractor, Sacramento, spent the first part of the week in San Francisco.

E. L. Haines, secretary and vice-president National X-ray Reflector Company, Chicago, is at San Francisco.

H. C. Rice, vice-president General Incandescent Lamp Works of General Electric Company, is at San Francisco.

S. B. Anderson, district manager San Francisco office, Pacific States Electric Company, visited the Seattle office last week.

E. A. Taylor is now with the Pacific Light and Power Company of Los Angeles, as commercial business representative.

Geo. Campbell, manager Stone & Webster interests near Reno, Nevada, and Mrs. Webster, were recent visitors at San Francisco.

H. L. Clark, representative of Westinghouse-Church-Kerr Company, San Francisco, returned recently from an extended trip throughout the East.

R. H. Sperling, general manager, B. C. Electric Railway Company, left Vancouver, B. C., for the East and will be away several weeks.

John Coffee Hays, president of the Mt. Whitney Electric Light and Power Company, Visalia, Cal., was at San Francisco during the past week.

F. H. Leggett, Pacific Coast district manager Western Electric Company, San Francisco, spent a few days recently visiting the Seattle section.

Andrew McPherson, has been appointed superintendent of the Southern Pacific Company's electrical system of the cities east of San Francisco Bay.

L. Kahn, vice-president and general manager Western States Electric Company, Stockton, was at San Francisco during the latter part of last week.

Henry M. Richards, of Spokane, a director of the Washington Water Power Company, was seriously injured in a runaway accident near Springdale, Wash.

G. I. Kinney, Pacific Coast manager of the Fort Wayne Electric and Sprague Electric Works of the General Electric Company, is visiting the Eastern factories.

J. A. MacMonies is back at San Francisco, having completed a business trip which very thoroughly covered the important cities in the central states and Canada.

Col. H. V. Carter, president Pacific States Electric Company, returned to San Francisco the latter part of last week from a trip through the northern part of California.

H. F. Holland, intermountain representative of the Simplex Electric Heating Company, has returned from an extended trip and vacation to the home office and factory at Boston.

P. D. Callahan, representing the Faries Manufacturing Company, Decatur, Ill., was in San Francisco last week and has left for the south, where he expects to remain for some time on company business.

C. N. McCallum, mechanical engineer, formerly chief designer in the engineering department of the Seattle Construction & Drydock Company, Seattle, has opened offices at 422 Mutual Life Building, Seattle, Wash.

Lee Shubert, president Colorado Electric Club, was a visitor at the Utah Electric Club luncheon Thursday and reported the rapid strides made by his club in the last few months. They now have a membership of 950.

C. T. Hutchinson, E. C. Jones, Thomas Morrin, Robert Sibley and **C. R. Weymouth** have been elected members of the executive committee of the San Francisco branch of the American Society of Mechanical Engineers.

James Colkitt, representative of John A. Roebling Sons Company, has been appointed Statesman of the Jovian Order at Los Angeles, Cal., and **T. E. Burger**, manager of the Western Electric Company, has been appointed alternate.

H. B. Lynch has been appointed superintendent of the proposed lighting plant at Burbank, Cal. He formerly was manager of the Glendale Lighting Company, and was at one time connected with the General Electric Company.

E. B. Criddle has been appointed acting general agent of the Southern Sierras Power Company at Riverside, Cal. **Fred B. Meckling**, formerly general agent at Riverside, has been placed in charge of the Nevada-California Power Company's Goldfield office.

Le Grand Brown, consulting engineer, has opened an office at 1307 Claus Spreckels Building, San Francisco, having been previously in another part of the same building. Mr. Brown, in addition to civil and electrical engineering, also specializes upon valuation work.

L. L. Nunn, president of the Idaho Power & Light Company, was at Boise, Idaho, last week in conference with **Mr. Bacon**, general manager, **H. W. Sanders** of Los Angeles and **Mr. Crane** of the Idaho Railway Company, in connection with the Swan Falls power plant.

B. C. Condit, chief engineer Northwestern Electric Company, Portland, Ore.; **John B. Fisken**, superintendent of light and power, Washington Water Power Company, Spokane, Wash., and **F. W. Harris**, consulting engineer, Los Angeles, Cal., have been transferred to the grade of Fellow in the American Institute of Electrical Engineers.

T. Miyaguchi, consulting engineer with the Nippon Electric Light Company, Lagami Hydroelectric Company and the Yokohama Electric Railway Company of Yokohama is a visitor at San Francisco. Mr. Miyaguchi is returning to Japan, having nearly completed a tour of inspection of the principal electrical manufacturing and generating plants in Europe and America.

Philip Dodd, "our Phil" of the electrical fraternity, has returned once more to the fold. Starting in the electrical field as manager of the "Electrical Review," the next step director of publicity of the National Electric Lamp Association, filling the secretaryship of several auxiliary branches of the association, recently connected with the Society for Electrical Development, he has now allied himself with the Tucker Agency, Inc., New York City. Mr. Dodd's work with the agency will be the organization of a special department for central station advertising service. Phil has a world of friends, who all wish him success.

F. J. Bates, Los Angeles Aqueduct Power Bureau, Surrey, Cal.; **J. Beane**, electrical superintendent U. S. Reclamation Service, Tahonton, Nev.; **C. S. Bennett**, construction foreman General Electric Company, San Francisco, Cal.; **L. M. Bockoven**, telephone engineer, Pacific Telephone & Telegraph Company, Los Angeles, Cal.; **H. T. Bonfield**, consulting engineer, Seattle, Wash.; **M. G. Brown**, president Northern Telephone & Power Company, Ltd., South Fort George, B. C.; **R. A. Brown**, chief engineer and general manager Calgary Lighting Department, Calgary, Alberta, Can.; **J. W. Cook**, chief inspector Vancouver Electrical Development, Van-

couver, B. C.; **S. Carnborough**, construction foreman C. C. Moore & Company, Kamloops, B. C.; **H. V. Mooney**, Heald's Engineering School, San Francisco, Cal.; **W. S. Oswald**, city electrician's office, Vancouver, B. C.; **F. Romig**, U. S. Electrical Manufacturing Company, Los Angeles, Cal.; **H. B. Summers**, 1336 West 49th street, Los Angeles, Cal.; **F. Tappan**, power recorder, B. C. Electric Railway Company, Vancouver B. C.; **W. J. Taylor**, assistant superintendent powerhouse B. C. Electric Railway Company, Lake Buntzen, B. C.; **H. P. Thomas**, city electrical engineer, Nelson, B. C., and **J. S. H. Wurtele**, consulting electrical engineer, Vancouver, B. C., have been elected associate members of the American Institute of Electrical Engineers.

MEETING NOTICES.

Electrical Development and Jovian League—San Francisco.

At the regular weekly meeting held last Tuesday at Tait's Cafe a paper by Mr. J. C. Collins, on Electrical Co-operation was read and discussed.

Los Angeles Section, A. I. E. E.

Mr. J. H. Montgomery will present a paper before the Los Angeles Section of the American Institute of Electrical Engineers, on Monday evening, November 24th, at Blanchard Hall. His subject will be "Electricity and the Fire Hazard." The December meeting will take the form of a popular demonstration of household electrical devices by Max Lowenthal. The ladies will be invited.

Jovian League—Spokane.

The regular weekly meeting of the Jovian League was held at Davenport's on November 11th, about thirty members being present. A short though enjoyable talk was given by Mr. Lane of the Home Telephone Company about his experiences when he first broke into the telephone game, which was in the very early period of development, M. C. Osborne, contract agent, Washington Water Power Company, spoke regarding his company's plans in connection with the sale of electrical appliances, of which the company intend handling a full line in the near future. The meeting was thoroughly enjoyed by all.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club held at the Commercial Club last Thursday, Professor Levi Edgar Young of the University of Utah delivered a talk on the History of Utah. Professor Young devoted himself mainly to the industrial history of Utah and the part which electricity has played in it. He pointed out that the pioneers of this state, in their speaking and writing, frequently referred to the fact that they anticipated that the numerous mountain streams would be harnessed and utilized for driving the various industries necessary in a prosperous commonwealth. Little did they realize, however, that electricity would be used as a medium to transmit this power hundreds of miles from the point at which it was generated.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The railroad commission rendered a decision granting authority to the Coast Valleys Gas & Electric Company to issue $114,000 of bonds.

The Campbell Water Company was granted authority to issue 19 shares of stock of the par value of $25 per share to replace stock illegally issued.

A decision was rendered granting authority to the Davis Water Company to issue $37,125 of stock in lieu of $29,700 previously authorized.

A decision was rendered granting authority to the San Rafael and San Anselmo Valley Railway Company to issue $55,000 of stock and $45,000 of bonds for the purpose of constructing a street railroad from San Rafael to Fairfax.

A decision was rendered declaring excessive and unreasonable all the long distance telephone rates of the Pacific Telephone & Telegraph Company in California. The commission cut the rates 21 per cent, and allowed two minutes for conversation as against one minute heretofore allowed. The commission's order required that 30 per cent of long distance revenues be credited to city exchanges instead of 15 per cent.

The San Diego Consolidated Gas & Electric Company was granted authority to issue $41,000 of bonds under a previous order of the commission.

The Spring Valley Water Company applied for authority to issue $1,000,000 of notes. The company desires to use the proceeds to pay off existing indebtedness.

PUBLIC SERVICE COMMISSION—MONTANA.

The public service commission of this state has ordered a reduction in the rates charged by the Helena Light & Railway Company, to take effect immediately. The reduction ordered amounts to approximately 1.6c per kw.-hr., and it is estimated that this will result in a total saving of approximately $30,000 per annum to consumers. Both residence and commercial lighting rates are reduced and heating and cooking rates and sign, exterior and window lighting rates are ordered added to the present schedules. The residence rate in effect before the recent order of the commission was 12.6c per kw.-hr. This has been reduced to 11c per kw.-hr. The monthly minimum is ordered raised from 80c net to $1.00 net, with 5 per cent added if bills are not paid before the 10th of the month.

The business rate was 10.8c per kw.-hr. and this is ordered reduced to 10c flat. The minimum charge was ordered reduced from $1.60 per consumer to $1.00 per consumer.

An optional "readiness-to-serve" rate was ordered added. This applies only to yearly contracts and consists of a fixed charge of 25c per month per 60 watts installed and 5c per kw.-hr. for all current used.

A heating and cooking rate of 4c per kw.-hr. was also ordered inaugurated; also a flat rate of 8c per kw.-hr. for signs, window and exterior lighting burning until 11 o'clock; 7c if burned until 12 o'clock; and 6c if burned until 1 o'clock.

In its report the commission states that its decision is not based on a valuation of the property and the cost of oprating it, but that in arriving at the rates ordered the rates in effect in Billings, Mont., were used as a basis with certain modifications of the minimum charges.

BOOK REVIEWS.

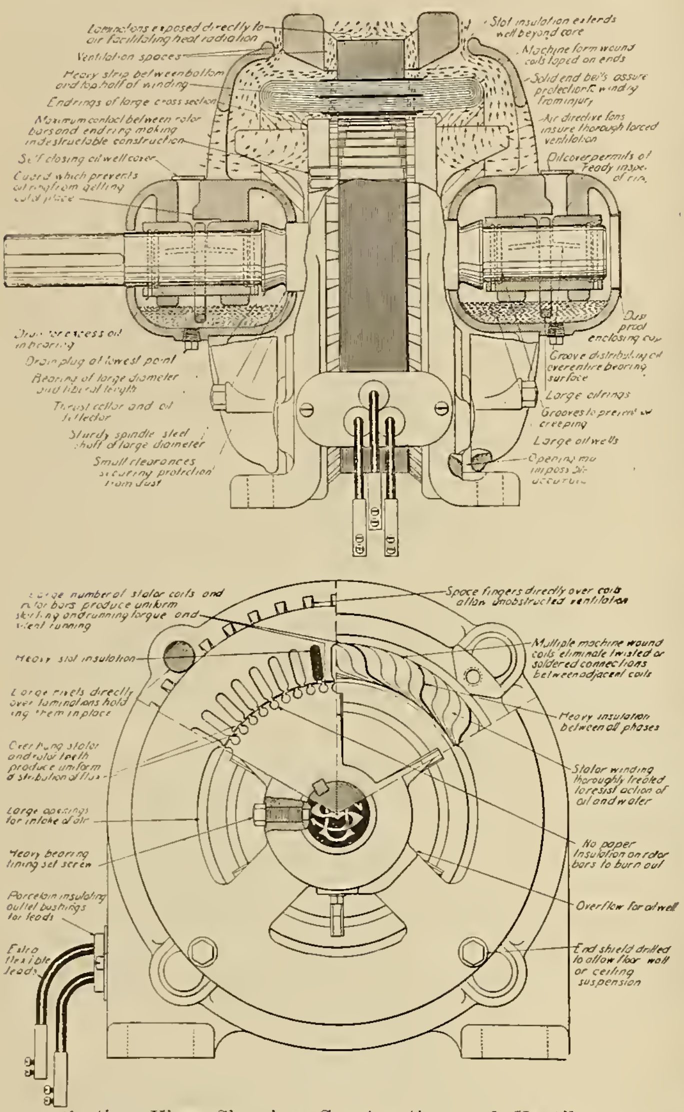
Electric Light & Motor Wiring. By Geo. J. Kirchgasser; 270 pp.; 4x2¾ in.; vest pocket size; leather bound. Published by The Electroforce Publishing Company, Milwaukee, and for sale by Technical Book Shop, Rialto Bldg., San Francisco. Price $1.00.

This practical book for the wiring contractor, electrical worker, electrical engineer, steam engineer, central station man, architect, or student, is invaluable as a ready reference. It may be continually to hand, as it can be carried in the vest pocket without inconvenience. It is compact but complete and tells in language which may be readily understood the methods of installing open knob, moulding, metal moulding, knob and tube work, flexible and rigid conduit and armored conductor systems. It contains over 150 illustrations which further aid the clear text. It does not simply develop the National Electric Code but tells how the installations are made and what the restrictions are for lighting and motor equipments. Methods are given for the calculation of wire sizes, and very complete motor and controller connections are given together with a number of valuable tables.

INDUSTRIAL

NEW TYPE OF INDUCTION MOTOR.

A new type of induction motor has recently been placed on the market by the U. S. Electrical Manufacturing Company of Los Angeles, Cal. The sectional view shown below conveys a good idea of the inside construction of the motor and shows plainly the ventilation characteristics. A riveted



Section View Showing Construction and Ventilation Characteristics.

frame is used instead of the usual cast iron type allowing the stator laminations direct contact with the outside air and at the same time contributing toward a very compact motor. At the present time it is made in sizes ¼ to 15 h.p.

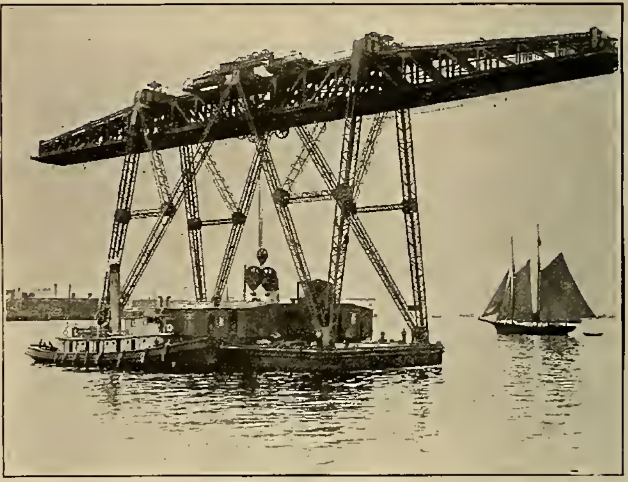
ASBESTOS METAL ROOFING AND SIDING.

Asbestos protected metal manufactured by the Asbestos Protected Metal Company of Beaver Falls, Pa., in the form of corrugated sheets is being used in large quantities as a permanent light roofing and siding material for covering tipples, washeries, breakers, pump houses and similar buildings in connection with coal mines. Asbestos protected metal makes possible skeleton incombustible steel construction of such buildings without the necessity of continued repainting and other maintenance expense.

The service on such mine structures is particularly severe and especially where high sulphurous coals are produced. Both the inner and outer walls of such buildings are continually covered with a fine coal dust, which, when subjected to the action of rain water or moisture of condensation, forms a mild sulphuric acid solution which is deadly to the existence of unprotected metal sheets as well as of paint films.

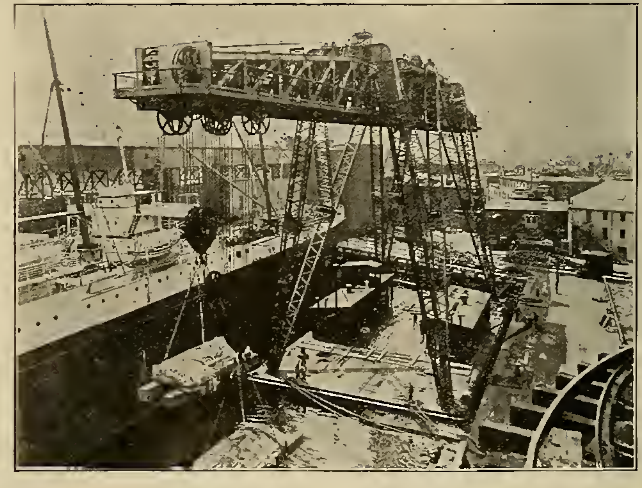
ELECTRICAL CONTROL OF PONTOON CRANES.

The United States Navy Department has recently had built by the Wellman-Seaver-Morgan Company two 150-ton pontoon cranes, one of which is for Boston Harbor and the other for Pearl Harbor, Honolulu. These cranes are to be used for transferring to lighters and for putting in or removing turrets, guns, boilers and other machinery or ap-



U. S. Navy Department 150-Ton Pontoon Crane.

paratus used on battleships. The two tests by Navy Department engineers noted below are an indication of the accuracy of control provided by the Magnetic type controllers installed by The Cutler-Hammer Manufacturing Company of Milwaukee. In order to test nicety of landing heavy weight, the weight was suspended over an empty oil can with block on top of it, and then lowered so as to strike the block, being



150-Ton Pontoon Crane in Operation.

stopped upon signal. It is possible to stop the load without injuring the oil can or deforming it. In order to further test this point, the weight was suspended about two inches over the block and then lowered to see how close it could be brought without touching, and was brought within 1/16 in. of the block.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—The Earlimart Water Company has been incorporated here.

RIVERSIDE, CAL.—The Riverside Telephone Company has been incorporated here by A. W. Campbell, Hugh Miller, H. M. Fryer et al.

SAN FRANCISCO, CAL.—The Physicians and Surgeons Telephone Exchange has been incorporated with a capital stock of $10,000, shares $1 each, subscribed $3, by W. C. and Katherine L. Vivell and J. M. Litchfield.

ILLUMINATION.

SAN RAFAEL, CAL.—The city council has decided to place electroliers on Fourth and B streets, and assess the property owners on both sides of the street for the cost of the same.

EL CENTRO, CAL.—Seeley is to have an electric light and power line, extension to be made by the Holton Power Company from the El Centro plant. The work will be done this winter.

CONCORD, CAL.—The board of trustees has passed the application for a gas franchise applied for by S. Waldo Coleman to print and on January 12th will sell the franchise to the highest bidder.

GLENDALE, CAL.—The Southern California Gas Company has applied to the commission for a certificate of public convenience and necessity to exercise franchise rights in the city of Glendale, Los Angeles county.

SAN FRANCISCO, CAL.—Plans have been completed for a one-story and basement class A power station to cost $45,000 to $50,000 on S. Commercial, 60 W. of Montgomery, for the Pacific Gas & Electric Company by Architect F. H. Meyer.

REDLANDS, CAL.—The board of trustees has awarded the contract for the installation of 37 cast iron ornamental lighting posts along Central avenue, Vine street, Fifth and Fourth streets to the Southwest Electrical Company, for $2975.

SAN DIEGO, CAL.—A lighting system that will cost $100,000 is petitioned by residents of Point Loma. Property owners ask for the formation of an assessment district, to include the whole of Point Loma. The main thoroughfares will be lighted with arc lights on ornamental posts, according to plans.

TACOMA, WASH.—A preliminary estimate of $37,127.84 as the cost of installing a White Way street lighting system in Tacoma was submitted to the city council by B. W. Collins, superintendent of electric works, and a motion carried ordering a resolution to be ready at the next meeting of the commission for advertising for bids for the completion of the work.

SALT LAKE CITY, UTAH.—Work on the new commercial office of the Utah Light & Railway Company on Main street is progressing rapidly and the company expects to occupy their new quarters about December first. The company plan to make their new office "the brightest spot on Main street," and will have on the front of their building about forty kilowatts in tungsten lamps and flaming arc lamps.

TRANSMISSION.

COQUILLE, ORE.—Twenty-four hour service has been inaugurated by the Oregon Power Company, here. It is anticipated that considerable sales of appliances will result.

BOISE, IDAHO.—It is said that steps are being taken to foreclose the Idaho-Oregon Power Company at a bankrupt sale, and that whether or not the Idaho Power & Light Company would purchase it at such sale would depend upon the price at which it was sold.

LOS ANGELES, CAL.—The city council is preparing to take up immediately, as a committee of the whole, the matter of leasing the power companies' distributing systems. In the meantime, action on the bond issue of $6,500,000, for the completion of power plants and construction of distributing system, has been deferred. It is understood that the city attorney will submit a tentative contract between the power companies and the city, which contract will ultimately have to be referred to a popular vote.

SAN FRANCISCO, CAL.—John Coffee Hays, president of the Mt. Whitney Power & Electric Company, announces that they will expend $1,600,000 within the next 14 months on improvements and extensions of the service. The work on the Wolverton dam, located back of the Giant forest and power plant No. 5 will be rushed to completion, and extensive improvements will also be made at the Visalia steam generating plant. New substations of a modern type are to be put in at Woodville, Terra Bella, Goshen, Strathmore and Erlimart, and the stations at Delano and Exeter will be increased in size.

GOLD HILL, ORE.—Work has commenced upon the power site of the Rogue River Public Service Corporation just east of this city, for the development of power required by its contract with the Beaver-Portland Cement Company. Next summer the work of constructing a permanent dam for the development of 5000 h.p., and the installation of a suitable plant, will be rapidly pushed to completion. Permit has already been secured under authority of the state. The Rogue River Public Service Corporation are successors to the Oregon Water & Power Company of which H. D. Reed was local manager.

OAKLAND, CAL.—An ordinance of intention to submit the question to the electors of this city whether the city of Oakland shall retain its power of control respecting certain classes of public utilities was passed in the city council on motion of Mayor Mott. In his address to the council the Mayor said: "The situation in Oakland with relation to public utilities is somewhat different from that of other cities in the state. We have here a number of public service corporations, which are serving not only Oakland, but adjoining cities as well, and there is a co-relation of interests in this regard that makes the question of rate fixing and other regulation of more than merely local concern. Better results would obtain not only to our city, but to all contiguous communities if the state railroad commission would be given power to handle the situation from the standpoint of the entire district rather than in detail."

TRANSPORTATION.

NAPA, CAL.—Plans are announced by the Northern Electric for the construction of a branch line from Napa Junction to Napa as a feeder to the company's San Francisco-Sacramento line, now under construction.

OAKLAND, CAL.—The first step in separating the management of the Southern Pacific's electric system of the east bay cities from that of the steam railroad system was taken when a superintendent was appointed for the electrical system.

SAN FRANCISCO, CAL.—The issuance of transfers between the municipal railway and the United Railroads at Kearny street and at Larkin street, has begun. The transfers from the Geary street road are good on both north and southbound cars of the United Railroads.

OAKLAND, CAL.—The Oakland, Antioch & Eastern Railway has entered into an agreement with the Pacific Navigation Company, whereby passengers from the south may purchase through tickets for any point on the Oakland and Antioch line. The interurban line will sell through passage to Los Angeles, good on the Yale and Harvard.

SAN FRANCISCO, CAL.—The public utilities committee of the supervisors has decided in favor of side instead of center poles for Van Ness avenue to support the trolley wires of the branch municipal railway line. In order that as much space as possible may be secured in the roadway it is the plan of City Engineer O'Shaughnessy to have the sidewalks cut from 22 to 18 ft. wide.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is preparing to utilize the municipal railway on San Pedro street as soon as it is completed. Until the elevated structure is erected, from the rear of the depot to San Pedro street, it is the purpose of the railway company to utilize the Seventh street service tracks. The elevated franchise will be brought up for action before the city council this week.

CASPAR, WYOMING.—Attorney Richard E. Shipp recently made application to the city council for a street car franchise in this city. Mr. Shipp claims to represent interests with sufficient backing to build the system at once. A line from the Franco Refinery No. 1 east of town down Second street to the Midwest Refinery on the west, is proposed, also from the Burlington depot up Center street to the southern boundaries of the city.

VISALIA, CAL.—The city trustees have granted a franchise to the Big Four Electric Railway to operate a city street car system in connection with its interurban line now building between Visalia and Tulare. A bond of $500 will be posted to insure the performance of the conditions of the franchise. Work must be started in 60 days, and completed in two years. All of the grade on the interurban line except a few miles, has been completed. It is expected the road will be in operation this winter.

SAN FRANCISCO, CAL.—The supervisors passed to print the ordinance granting the Southern Pacific Company a new franchise to cover changes of track and building in Townsend street, but without eliminating conditions to which the company had objected. It was said the free-switching condition, if insisted on and carried out, would mean a saving to business men of $300,000 a year. Other conditions give the city cars a right of way over the company's tracks, and provide that the company shall not only keep the pavements in order, but also shall light the streets.

SAN RAFAEL, CAL.—The promoters of the proposed San Anselmo Valley Electric Railroad have been granted authority by the railroad to build the road which will connect San Rafael at a point near the Union station with San Anselmo and Fairfax. A single 5c fare is to be charged. The commission authorized an issue of $55,000 in stock and $45,000 bonds, all to be sold at par. In its order the commission provides that no work may be begun upon the project until 90 per cent of the stocks and bonds shall have been subscribed and $50,000 paid in and placed in the bank.

LOS ANGELES, CAL.—The railroad commission has been considering the proposition of track elevation on Alameda street at its session held in Los Angeles during the past week. This has developed into a controversy with many angles. On the one hand there is the Southern Pacific, with plans completed and contract ready to let for the new depot on the Arcade site. There is the railroad commission, seeking to solve the grade crossing problem in an impartial manner. Then again, there are certain commercial interests for and against track elevation and the depot proposition in general, according to the benefits to be derived or damages to be caused, due to the adoption of any report which may be made by the commission. If the tracks are elevated there will be a tremendous loss or inconvenience to certain commercial interests now served by spurs from existing service tracks. The city council has practically given its consent for the immediate construction of the depot, but it is probable that the plans will be held in abeyance for some weeks yet, due to an undefined but localized opposition.

TELEPHONE AND TELEGRAPH.

VENTURA, CAL.—The Pacific Telephone & Telegraph Company's application for a new 50-year franchise to be offered for sale has been granted by the board of trustees. and the proposed franchise will be sold at public auction on December 15th.

ESCONDIDO, CAL.—N. K. Gray, line manager for the Pacific Telephone & Telegraph Company, is making arrangements for rebuilding the telephone line between Escondido and Ramona, three miles of which was destroyed in brush fires in September.

PLACERVILLE, CAL.—The supervisors have sold to C. R. Lorraine et al. the right to construct a rural telephone line along the Green Valley road, from Rescue to the Sacramento county line, and along the Deer Valley Road, and to operate the same for a period of 50 years.

SAN FRANCISCO, CAL.—The Marconi Wireless Telegraph Company of America announces reduced rates, effective immediately, to and from vessels at sea. Coastwise vessel charges have been reduced to 5c per word, and forwarding charges to inland points over the land wires has also been reduced.

LOS ANGELES, CAL.—The city council has abolished the position of electrical engineer, bureau of fire alarm and police telegraph. The bureau has been placed under the jurisdiction of the department of electricity, and an advisory board, consisting of the mayor and the chiefs of the fire and police departments, will have a general supervision over its affairs. City Electrician Manahan will supervise the construction and operation of the system.

SAN FRANCISCO, CAL.—The railroad commission has declared excessive and unreasonable all the long distance telephone rates maintained within the state of California by the Pacific Telephone & Telegraph Company and substituted an entirely new and reduced schedule. The commission cuts the present long distance rates of the telephone company by 21 per cent and in a sum amounting to $526,000 per year. The commission finds that the schedule which the telephone company desired to maintain yielded a return in excess of 14 per cent. The rates as fixed by the commission are calculated to yield slightly in excess of 9 per cent. The new rates go into effect on February 16th and the result will be a realignment upon a reduced basis of nearly all of the long distance telephone charges within the state. The commission fixes the rate at ½c per air line mile for minute conversation, with 50 per cent increase for every additional minute or fraction thereof. The commission requires 30 per cent of long distance revenues to be credited to city changes. The company heretofore allowed 15 per cent. The decision divides the state into blocks and sections for rate purposes following postal route zones.

SPOKANE, WASH.—John E. Davies, general counsel, vice-president and secretary of the Interstate Consolidated Telephone Company, on cross-examination in the government's investigation into an alleged telephone trust, admitted that a subsidiary of the American Telephone & Telegraph Company had purchased control of the Lane independent companies in Idaho, Montana and Washington. Former testimony of Davies indicated that the Bell company had bought stock, but not control. Officials and counsel of the American Telephone & Telegraph Company also admitted control of the Lane independent companies, and cited that such control was stated in an answer filed in the Federal Court in Seattle in June, 1912. The Bell companies have control through the Corporation Securities & Investment Company.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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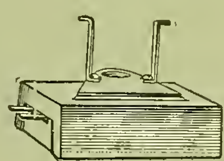
Each unit consists of four parts



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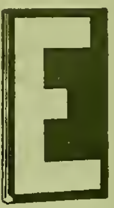

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and when combined make a neat, attractive, legible, distinct letter.

The sockets as well as the letters are interchangeable, enabling any combination of letters or words to be made.

They catch the eye, hold the attention of the evening crowd and are equally as practical in the daytime.

Do not require a stand or any permanent fixture. Can be plugged into any lighting fixture socket. There are no letters to be renewed in case of a burnout. Replace the individual incandescent lamp and the sign is again complete.

Whenever it is desired to change the sign the window-dresser can make his own changes as often as desired.

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI | SAN FRANCISCO, NOVEMBER 29, 1913 | NUMBER 22

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CENTRAL CALIFORNIA GAS COMPANY'S SYSTEM

BY RUDOLPH W. VAN NORDEN.

A system of gas transmission, modern, efficient and interesting, is in operation throughout the more populous part of Tulare county, one of the largest and richest of California's counties. This, the system of the Central California Gas Company, is primarily a consolidation of two widely separated installations, conventional in their kind, similar to many small plants which may be found operating in small ways in small cities—perfectly good and serviceable from the conventional standard. The most important consideration for the new organization was the possibility of enlarging so as to supply gas to those entirely beyond the scope, physically or economically, of the old nucleal systems. To spread out upon the basis of methods and operation costs of the old plants would have invited failure. To spread out successfully required a move along new lines, a study of plant economics along every line, proper plant design for low cost of operation, centralization of plant operation, modern simplified methods of business control, a desire to give to the public all that it possibly can and a flexibility of system which can anticipate a rapid growth by being able to meet this growth easily and efficiently.

The Central California Gas Company was organized in 1912 to purchase the Home Gas Company of Porterville, and the Consolidated Heat, Light & Power Company of Visalia and Tulare, and with the intention of connecting these plants, through a transmission pipe line and incidentally to supply the intervening towns. All of the acts of this company have been strictly under the supervision of the railroad commission of California and it is interesting to note that the application for a certificate of public convenience and necessity requiring the exercising of a franchise in Lindsay, was No. 1, the first certificate issued under the law by this commission. Following this there have been other certificates and orders issued by the commission, amounting to nine in all. These authorized the purchase of the gas systems in Porterville and Visalia, the franchise in Exeter, Lindsay and Porterville and all of Tulare county outside of incorporated limits, for the transmission line, and for the right to issue bonds.

Visalia is the county seat of Tulare county, well laid out with wide well paved streets, many substantial business houses, beautiful homes and an undeniable air of prosperity. The city has a population of 6,000 and is served by both the Southern Pacific, the Atchison, Topeka & Santa Fe, and an interurban electric railway. The plant of the Consolidated, Heat, Light & Power Company in this city was selected, both from its location, the cost of fuel and its possibilities, as the site for a central plant from which all

General View of Central Gas Plant at Visalia. This View Shows All Apparatus From Oil Storage Tanks on the Left to Outgoing Pipe Lines on the Right.

points in the county to be supplied with gas service should radiate. The purchase of this plant included a transmission pipe line to the city of Tulare where gas was being distributed.

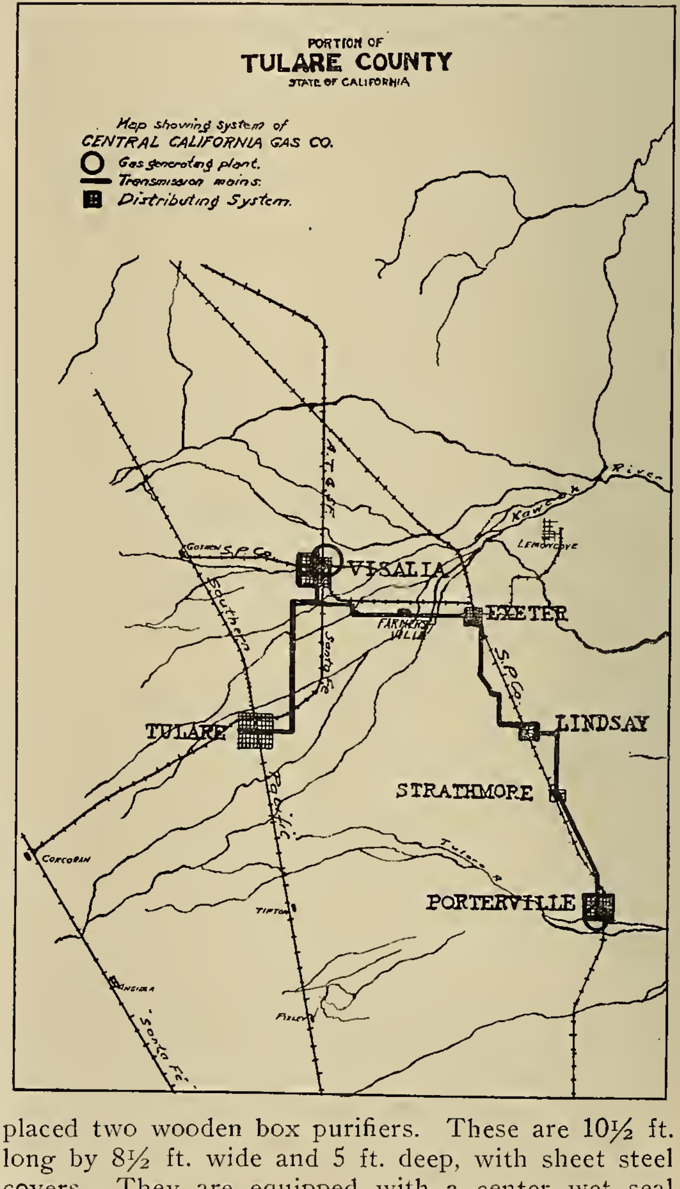
Gas Holders and Tight Box Purifier.
View of Plant From Street.

The Central Generating Plant.

The new plant in Visalia is situated on the property acquired from the former company and employs in its operation as much of the older equipment as is compatible with the proper operation of a much larger service along economic lines very much improved. It covers a city block and has an area of 1½ acres. Of this, about one-half is occupied by the present plant, which allows for enlargements and extensions in a thoroughly pre-arranged plan of construction, as the demand for gas shall increase.

The older installation is housed in a brick building 50 ft. x 32 ft. and this with its contents stands practically unchanged, its roof forming a part of the general roof covering of the plant. Its front wall is on the street and property line.

The apparatus installed in the older system, consists of two return tubular boilers, one of 35 h.p. and the other of 50 h.p. each, in a brick setting. In the central part of the building are two Western type, crude-oil gas generators, 4½ ft. and 6 ft. in diameter, respectively, and 14 ft. high; two superheaters, one 4 ft. and the other 4½ ft. diameter and 17 ft. 9 in. high. These gas machines are so arranged to connect to a common wash box. This has a vertical cylinder 4 ft. high and 6 ft. diameter and is supported on a steel frame 6 ft. above the floor level. In the rear of the wash box are two scrubbers, each 4 ft. diameter and 14 ft. high. These machines have a combined capacity of 28,000 cu. ft. of gas per hour, and are kept in order, ready for emergency service although so far there has been no call upon them. The Western type of machine is much in use on the Pacific Coast and where crude oil is used as a gas making fuel. The service of the new company contemplated a use of gas far in excess of the capacity of these machines and the design of the new plant along lines of better economy necessitated the disuse of this apparatus except for emergency. For this reason the operating connection with the new system has been maintained. Adjoining the room containing the generators and auxiliaries just described, is a small room in which are placed two steam driven compressors and two blowers. The compressors were originally installed to raise the holder pressure to the transmission pressure for delivery both in Visalia and to Tulare. One of these is a Laidlaw-Dunn-Gordon, steam and air type; size of cylinders 10 in. x 12 in. x 10 in. stroke. The other is a Simplex of practically the same type with cylinders 9 in. x 10 in. x 12 in. stroke. Of the blowers, both are Sturtevant, the one No. 4 and the other No. 5, the first is belt driven by a "Climax" 15 h.p. simple horizontal steam engine, while the other is belt driven by a "Jewell No. 3" engine of similar rating and type. In a shed north of this room are



placed two wooden box purifiers. These are 10½ ft. long by 8½ ft. wide and 5 ft. deep, with sheet steel covers. They are equipped with a center wet seal for operation and wet lute. The combined capacity of these purifiers is 30,000 cu. ft. per hour.

Holders.

Placed to the north of the gas house are two single lift Stacy steel tank Eastern type gas holders, both of which were a part of the old plant equipment. The smaller of these holders has a capacity of 10,000 cu. ft.; this has an outside diameter of 27 ft. The larger of the holders has a diameter of 60 ft., and a capacity of 50,000 cu. ft.

The oil and water pump equipment of the older installation is in use in the new installation and will be described in that connection.

The method of lampblack disposal has been entirely remodeled, while the fuel oil tanks have been enlarged and improved for a heavier service.

Of the older installation described, the gas machines and scrubbers, blowers and compressors are not in regular use, but the purifiers, holders, boilers and pumps and some of the old piping are.

New Installation.

In the design of the new installation, it was planned to arrange all apparatus so that operations would be in sequence; to afford a minimum amount of handling and manual labor; to insure the greatest simplicity in plant construction; the utmost safety in operation by removing so far as might be possible weak or obscure points in the system. In carrying out this idea, the entire street frontage was put to use as a basis from which to gradually spread the plant across the property.

Beginning with the corner and adjoining the railway is a building 42 ft. x 24 ft. which is divided into two compartments. The larger of these is a warehouse in which all supplies for the physical maintenance, repair and extension of the system are kept. Shelves and bins properly classified make possible a checking system by which all material incoming and outgoing may be indexed. In the other compartment is the meter testing, repairing and storage department. This is equipped with bench and tools and a meter prover used in the work of testing and adjusting service meters. On the railroad side of this building is a platform, while on the other side is a loading platform, the driveway into the plant entering between this building and the boiler house.

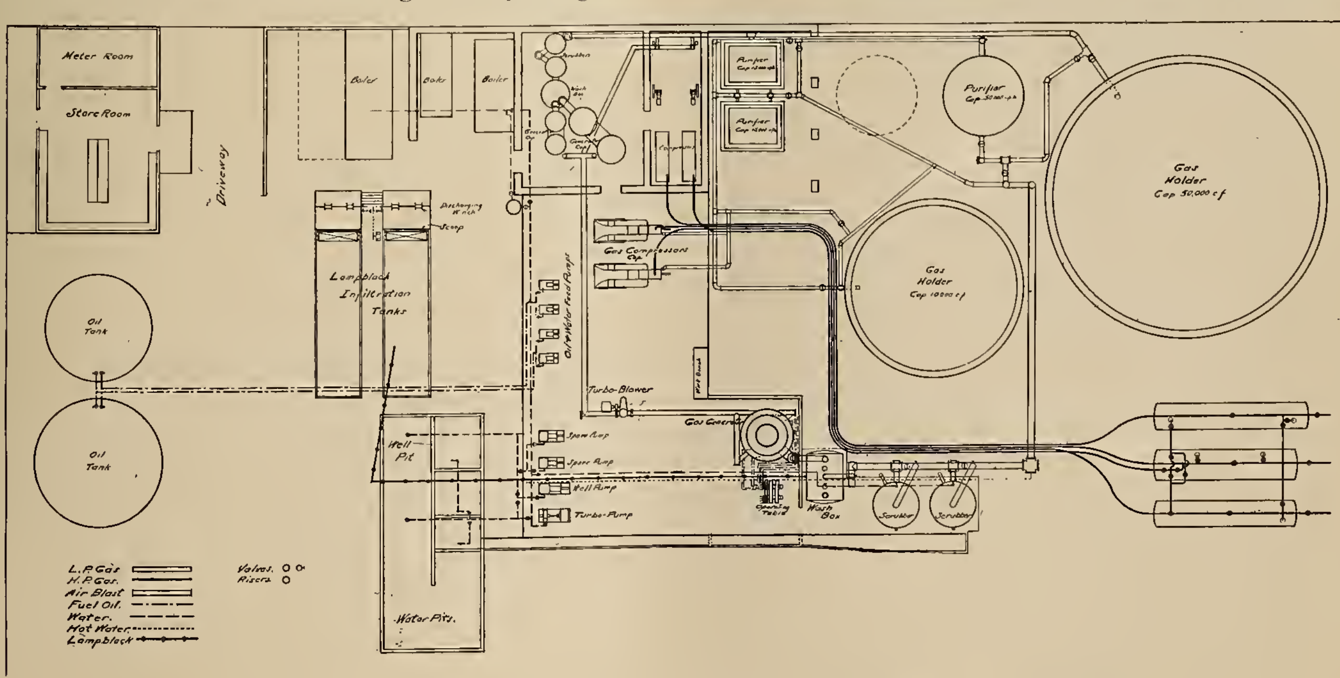
Next to the warehouse and also adjacent to the railway are the fuel oil tanks. There are two of these built of concrete, the bases being brick upon which is laid a floor of concrete. The first tank has a diameter of 21 ft., and a depth of 8 ft. 10 in., and its capacity is 25,000 gal. This tank has a concrete cover. The second tank has a diameter of 30 ft. 8 in. and the depth is 11 ft. The capacity is 50,000 gal. The cover of this tank is conical, built of wood and covered with tarred building paper. Oil is delivered directly into the tanks by gravity from cars which are spotted on the railroad siding. The outlet piping and valves are above ground permitting accessibility and easy inspection.

Beyond the oil tanks and adjoining the railway right of way is a corrugated iron lavatory and bath house 16 x 20 ft. This feature, so carelessly overlooked in many older plants, has proven to be of the greatest importance to the welfare of the operators and is thoroughly appreciated. Aside from ample lavatory and toilet arrangements there is a hot and cold shower bath and sanitary lockers are provided for all employes.

It will be observed that the placing of the warehouse is such that incoming and outgoing materials may be handled without carrying into the plant and hence without interfering with or being in the way of other operations. The lavatory building is also so placed that it is reached without entering the plant proper, and upon leaving, after an employe has cleaned up and changed his clothes, it is not necessary to pass through any part of the plant.

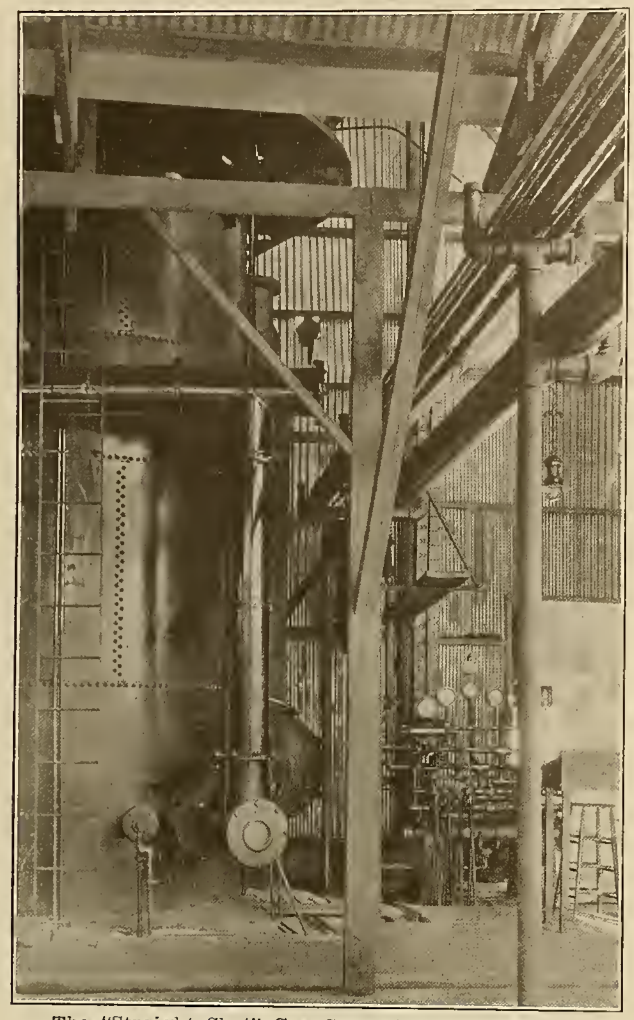
Boilers.

The space between the driveway and the old boiler installation being sufficient, has been used as a continuation of the boiler room within which to place two new boiler units. Of these one has been



Plan of Plant Layout, Showing Principal Oil, Water, Air, Lampblack and Gas Piping.

installed. This boiler has a rating of 100 h.p.; it is of the return tubular type and was furnished by the Baker Iron Works of Los Angeles. This boiler has a brick setting with one side finished so that the second boiler may be placed directly against it. The extension of the boiler house building is of galvanized



The "Straight Shot" Gas Generator and Operating Table. Hot and Cold Water and Oil Supply Pipes and (Lower) Lampblack Conveyer Pipe, on Elevated Pipe Frame.

corrugated iron and is open on the plant side. The three boilers, including those of the old installation, are now in constant use. All are equipped for oil firing and have Anderson crude oil burners, all of which receive their supply through a heater from steam driven fuel oil pumps. The furnaces under all of the boilers are equipped with grates upon which the lamp black by-product from the manufacture of gas is consumed and which furnishes a part of the heat necessary in the generation of steam from the boilers. It is necessary in using lampblack as a fuel to supply a certain amount of crude oil fuel which serves to coke the lampblack. It would not be possible to burn the lampblack without this assistance. A relatively small amount of fuel oil is required, but as the fuel requirement is in excess of the lampblack production, it becomes necessary at times to augment this deficiency by an increased consumption of oil. The method of handling the lampblack is unique and forms one of the notable and interesting features of this plant. A detailed description of the apparatus and its operation is given later in this article.

The New Generating Plant.

Following a carefully pre-arranged plan for enlargement upon simple lines, to at all times allow of economic operation, the new generating plant has been placed well back from the old plant building toward the center of the property. A concrete operating floor was laid slightly above ground level, to allow for drainage. This floor covers a space 38 ft. wide, thus coinciding with the length of the old brick gas house. It extends toward the center of the lot 66 ft., and its entire area is given up to the pumps, compressors and blowers. Over the operating floor is a corrugated iron roof, supported on simple wooden trusses which in turn are carried by wooden columns at the sides, but otherwise this operating space is not housed. The climate of the San Joaquin valley is such that for most of the year an open operating space is desirable to the comfort of employes and to cleanliness and ease in operation. During the rainy months when there may be experienced some cold weather, the climate is never rigorous enough to interfere with ordinary operation, as there is sufficient waste heat generated about the plant to provide for the comfort of the operators. At the rear end and to one side of the operating platform is the gas generator and operating table. The space occupied by these machines is roofed over and also enclosed, although it is open to the operating platform. Directly behind the generator building, but without protection of any sort, is the wash box, followed by two scrubbers. Under all of this apparatus is a heavy concrete floor laid directly on the ground, there being a low concrete barrier at the edges of the concrete floor and surrounding each piece of apparatus. This is for the purpose of collecting water from or about the apparatus and drain it into a concrete canal. The canal, which is formed out of the concrete of the floor, is open, has a width of from 3 to 4 ft. and extends from the further scrubber along the edge of the concrete floor, passing within the generator room and along the back edge of the operating floor, emptying finally into the water pits from whence it may be cooled and re-pumped into the system.

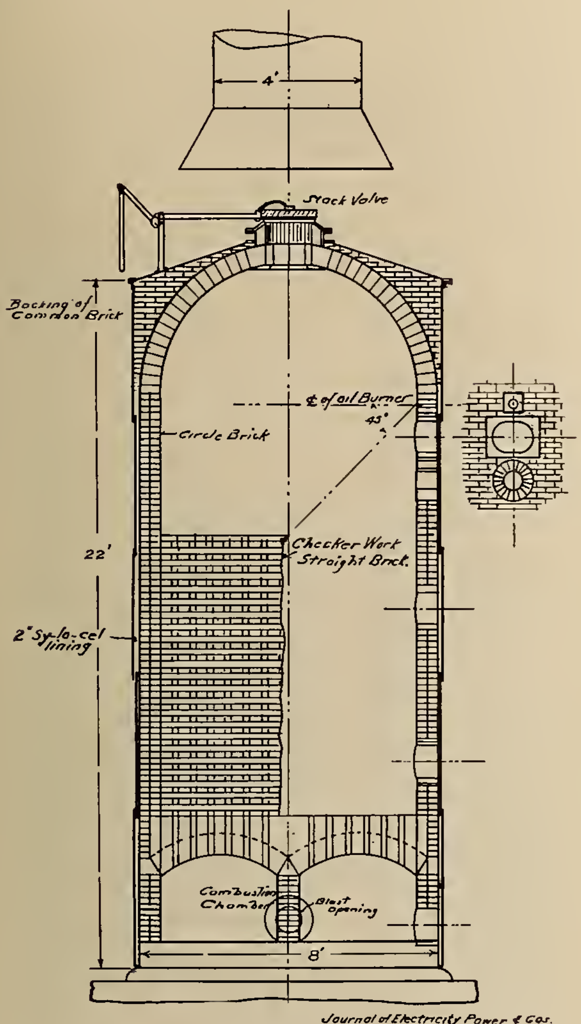
Beyond the scrubbers and conveniently located with respect to piping arrangements, are the three line pressure tanks, and in a space between the old plant purifiers and the larger of the two gas holders are to be two purifiers of 50,000 cu. ft. per hour capacity each, one of these purifiers being now in place and in use.

Generator.

The principal apparatus in the equipment of a gas plant is the generator, more commonly called the gas machine. On the design and operation of this apparatus depends the first and principal economic duty of the plant, the quality and constitution of the gas, and its operation has much to do in the determination of the style and design of the auxiliary apparatus, its arrangement and operation.

Much has been said and written of the improvement and duty of gas machines where crude oil is used for fuel, especially on the Pacific Coast and there are those who have been identified with the development of the gas manufacturing industry, who will easily rank as the leaders in this vast branch of public serv-

ice enterprise. There is, however, as in most branches of industrial research, a division of opinion as to economic methods of product manufacture, where there are many points favored by authorities of either side. This condition holds true to a certain extent in the gas making field.



Cross Section of Straight-Shot Gas Generator.

Two general types of gas generator may be ordinarily found in gas plants on the Pacific Coast, the one, known as the Western type, which has been developed with especial reference to the use of crude oil fuel and which is the most generally in use, while the other an adaptation of Eastern practice for the use of crude oil fuel, commonly known as the "Straight shot," machine. The first of these generators is in two parts, each generally a vertical cylinder in which the first is a combustion chamber in the lower part of which is a checker work of firebrick. The second part connected to the first across the bottom of both cylinders, contains only checker work with an outlet at the top; this cylinder is called the superheater. The operation of gas making consists in first heating the checker work in both cylinders from an oil flame and air blast in the combustion chamber of the first cylinder, the product of combustion passing through a valve into a stack from the opening in the top of the second cylinder. When the checker work is heated to a proper temperature, the stack valve is closed. This has the effect of closing the machine. The blast of air is stopped and the oil is injected as before into the combustion chamber where it is immediately vaporized, but is not ignited, as the generator is closed and has no air supply and so does not provide the requisites for combustion. The outlet valve is now opened into the outlet pipe to the wash box. Vapor formed in the combustion chamber passes through the heated checker work where it is "cracked" or broken up into its chemical constituents, the lighter hydrocarbons forming lampblack. These products pass over into the superheater and the operation of cracking is completed while passing through the checker work in this part, care being taken not to over-heat the gases at the end of the operation, causing a further chemical breaking up and changing the desired quality of the resulting gas.

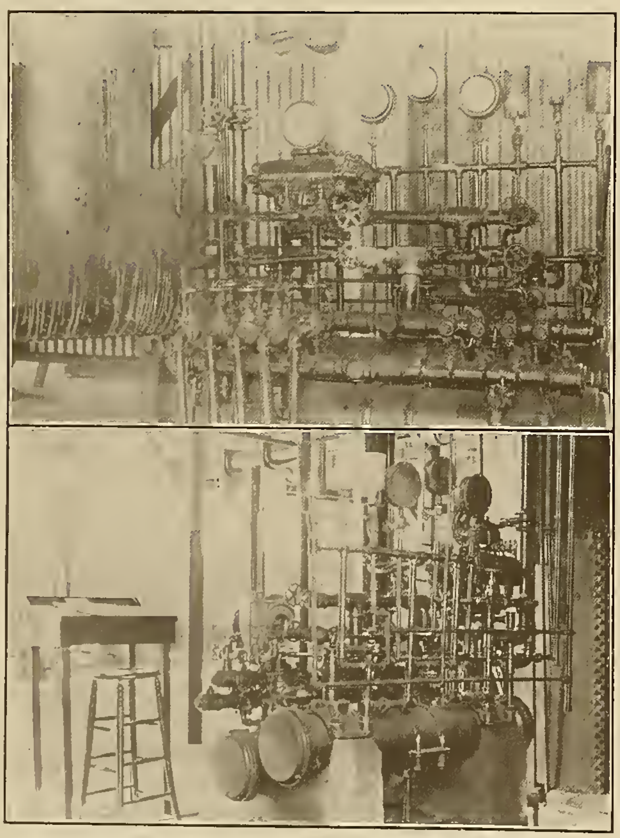
The "straight shot" generator accomplishes the same result but it is done in a single cylinder and the "blasting" and "making" operations occur at opposite ends and in opposite directions. The generator consists of a sheet steel casing within which is a double lining of fire resisting brick. The combustion chamber is at the bottom, oil-burners being introduced at one or more points around the side of the chamber. The combustion chamber is arched over with a perforated fire brick on which is supported a checker work of fire brick extending well toward the upper end of the generator. Above this is the vaporizing chamber or carburetter and through the walls of the machine into this chamber are introduced the oil nozzles for vaporizing the gas making fuel. Above this chamber is a stack opening into which is introduced a "stack-valve." In operation the first act is the blasting, when the combustion of the oil at the lower burners assisted by a powerful blast of air, passes upward through the checker work and out of the stack valve. This heats the checker work to the desired temperature for gas making. After blasting for a certain time, the oil flow and air blast are shut off, and the stack valve is closed, making the generator air tight. The oil supply at the upper end is now turned on and the vapor formed passes down through the hot checker work where it is cracked, into the combustion chamber and then out through the gas outlet pipe to the wash box, the only means of escape.

In the design of this system the straight shot type of machine has been adopted (although the equipments of the old plant, as already described are of the Western type). The plant has been laid out for the immediate use of two generators, either one of which should have a sufficient capacity to supply the needs of the consolidated system, considerably in excess of present requirements. Of this equipment, one machine has been installed, with all auxiliaries so arranged and of capacity to handle the output from two machines. This makes it possible to install the second generator on very short notice and at small cost compared with the original installation, whenever the demand for gas shall exceed the safe margin of operation of the present equipment. The object of installing the type of machine adopted was on account of its greater efficiency and lower cost due to its great capacity and simplicity of operation. While some authorities may argue that these features do not

always apply, it would seem in the instance of this plant, from results of operation, that the selection of this type of machine was entirely justifiable.

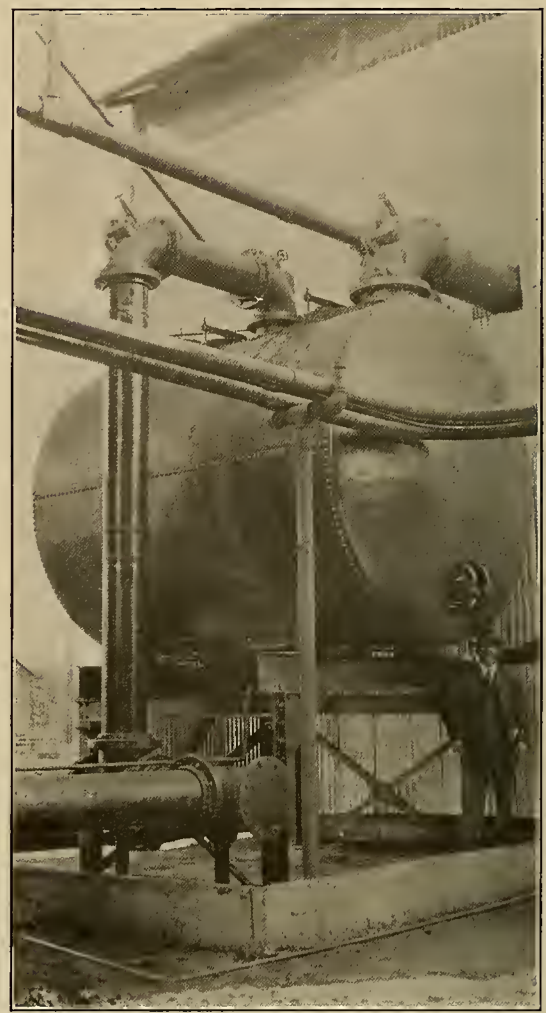
The generator was designed by Henry W. Burkhart, a consulting gas engineer of Los Angeles, and was built by the Baker Iron Works of the same place. It has an outside diameter over the steel shell of 8 ft., and the height from the floor to the stack valve is 22 ft. The stack is somewhat larger than general practice for this size of machine, being 4 ft. diameter. The shell has a double lining of 10 in., 3-Star gas circle-firebrick. The top of the shell is cone shaped, which allows the lining of the top to arch over from the sides without taking up space within the shell for the arch. The spherical top also prevents deposits of waste materials.

The checker work is composed of straight brick 4½ in. x 2½ in. x 9 in. This is supported on a four-way arch of checkered fire brick and at the center by a column of the same material. The combustion chamber is between the floor and the arches and has a height of 3 ft. There are four oil burners in the combustion chamber, placed in pairs, diametrically spaced around the circle of the chamber. These are introduced on an acute angle with a radius. Between the burners of each pair is introduced the air blast inlet, which, due to its position and the direction of the oil spray, gives a whirling motion to the flame so that its action on the sides and through the checker brick



Front (Upper) and Rear Views of the Operating Table.

tends toward a very efficient heating effect on every part. The oil supply nozzles into the making chamber are placed in a plane below the spring of the roof arch and the depth of the chamber below the oil supply nozzles to the top of the checker work is such that a line from the nozzle to the center of the upper surface of the checker work makes an angle of 45 degrees with the central axis of the machine. A steel inspection platform encircles the machine near the top to facilitate operation and inspection. Air from a steam turbine driven centrifugal blower is brought to the combustion chamber through two 12 in. sheet steel pipes which branch from a main, and within



The Wash Box. High Pressure Gas Piping in Foreground.

each, close to the generator is a castiron disc, quick-opening valve for regulating the blast. The gas outlet pipe from the combustion chamber has a vertical section 30 in. in diameter and 10 ft. high and this is lined with a double lagging of fire brick. This is necessary as the gas leaves the generator at a temperature of about 2200 degrees. There is a 30 in. door in this outlet through which entrance to the generator may be had for inspection or repair. On top of this vertical section is a 16 in. T and from this a 16 in. castiron pipe passes horizontally through the rear wall of the building and connects to one end, on top of the wash box, through an elbow and thence down into the box, to well below the center line.

Operating Table.

One of the interesting features of this installation is the operating table. This bears much the same relation to the gas machine, that the switchboard does to electrical generating machinery.

The operating table consists of two sections of 12 in. wrought iron pipe, 6 ft. long, laid horizontally side

by side and mounted on two concrete piers. These act as small reservoirs for fuel oil and steam. From one end a set of eight 2 in. wrought iron pipes, four from each header line above the tanks, are brought out at a convenient height from the floor for handling, and in each pipe is an operating valve. These valves control the steam and oil flow to each nozzle. The position of the valves with respect to each other is staggered, making two rows, the four valves in one row controlling the blast, and the others the make. At the other end of the table a similar provision is made to operate the second generator.

On one end of the operating table are mounted a pair of direct reading oil meters and beyond are mounted steam, air and water gauges, photometer gauge and burners to indicate the quality of gas being made. An elaborate and ingenious system of piping is necessary here. The gas-makers' desk and log-book stand close to the table and the entire operation of blasting and making gas is efficiently controlled by one man with almost no necessity for movement away from this point. This operating table is the design of Mr. W. A. White, general superintendent of the plant.

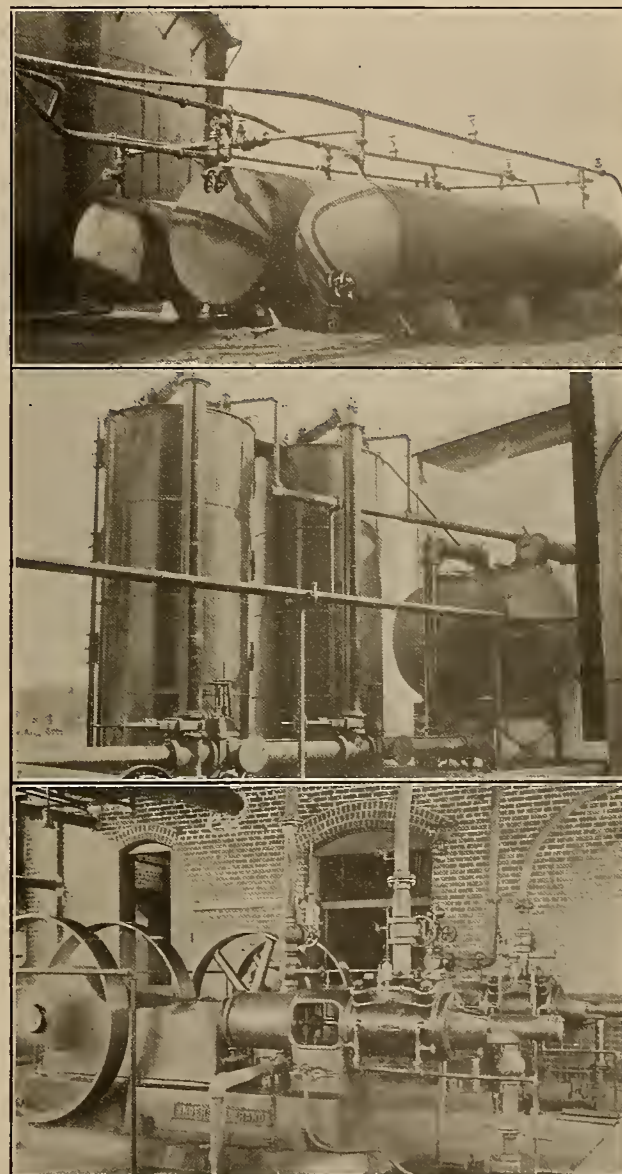
Wash Box.

The wash box is a horizontal cylinder, 8 ft. in diameter and 12 ft. long. It is made of sheet steel with riveted joints and has dished heads and is mounted so that it clears the ground 6 ft., on a structural steel frame. There is a covered opening on top at the opposite end from that of the gas inlet pipe to provide for another feeder from the second generator. At the center of the top is the outlet from which the gas passes to the scrubbers. Underneath are two manholes with hinged covers to permit rapid cleaning.

This wash box as designed by Mr. Burkhart is unique in gas practice and has proven of high efficiency in operation. The wash box is the first auxiliary in the manufacture of gas for the purpose of its purification. Its intent is two-fold. The gas enters at a high temperature from the generator, passes through water in the wash box, and its temperature is thus lowered to 110 degrees F. The passage of the gas is rapid and more or less violent, but serves to filter out a large proportion of the lampblack, which is in the form of an impalpable powder. An 8 in. outlet at the side of the box somewhat below the water surface, in order to form a water seal, to prevent the escape of gas in the box above the water surface, allows the water with its load of lampblack to flow away. This pipe at an elevation of 10 ft. above the floor is carried on iron pipe column supports across the operating floor to the lampblack infiltration tanks, into which it is discharged. In order to maintain a supply of water and to properly distribute it to cause a maximum of agitation in the wash box, a 2 in. wrought iron water pipe connects to a 6 in. header line delivering water from the pumping system under 40 lb. per square in. pressure. This is brought into the top of the box. It connects through a T to a horizontal header of the same size within the box near the top. At either end of this are two branches circling down to conform with the curvature of the box, to about the water level. The ends of these curved pipes are then connected by two horizontal sections reaching the length of the box. All of this piping is perforated with 1/8 in. holes and the many streams resulting permeate the gas, further removing lampblack and maintaining the supply level in the box.

Scrubbers.

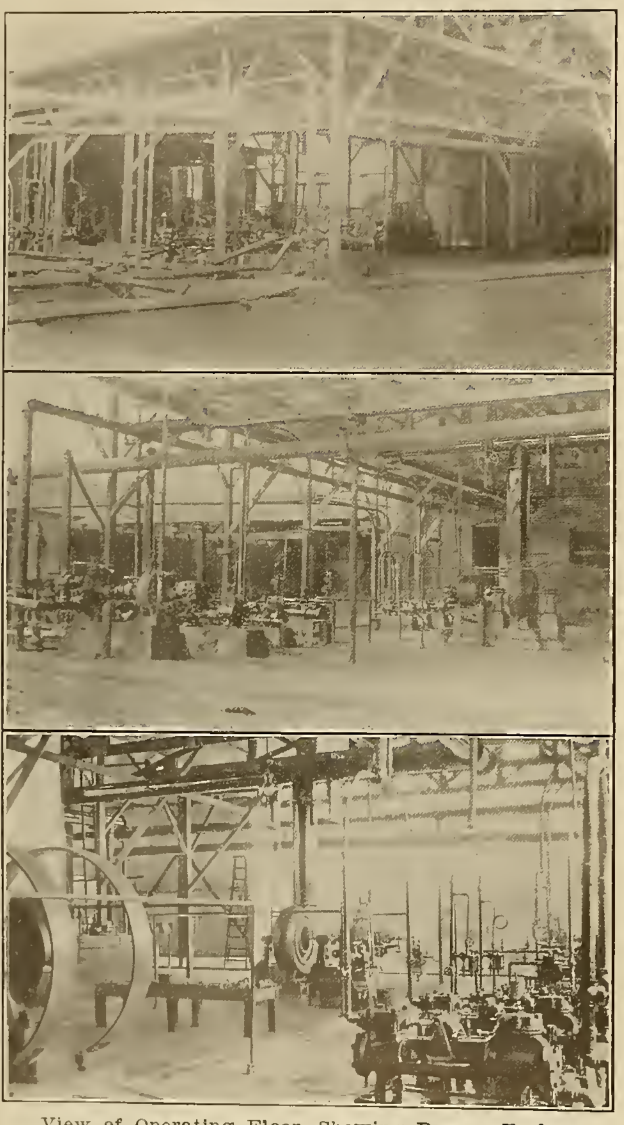
After passing through the wash box, the gas has lost much of its heat and most of the suspended lampblack, but still contains impurities undesired in the finished product—a small amount of lampblack; ordinarily a small quantity of asphaltic tar; sulphur in the form of hydrogen sulphide (H_2S) carbon dioxide, an



High Pressure Gas Tanks, Showing Universal Switching System. The Scrubbers and Wash Box (Right). The Gas Line Compressors.

inert gas so far as heating value or illumination is concerned; and a number of other ingredients in form of hydro-carbons or inert gases, generally in small quantities. The gas now passes from the top of the wash box through a carefully designed piping system to the top of each scrubber. Within the scrubber cylinders is a closed loop of 1 1/4 in. pipe extending across the top, down both sides and connected across the bottom. At 4 ft. intervals, plugged elbows are screwed into this pipe loop, each containing a narrow slot to form a

spray nozzle. These nozzles on opposite sides alternate with respect to each other and deliver water sprays which completely permeate the interior of the scrubber. Connection through the top of the scrubber is made to the 6 in. cold water pressure line and also to a 3 in. hot water line brought from the boilers. The cold water sprays remove the remainder of the lampblack and precipitate any tar which may be contained in the gas and incidentally further lower the temperature of the gas to 90 degrees F. The hot water connection dissolves the tar, which is discharged into the tar well. It may be noted here that very little tar is formed in this system. The gas outlet of the scrubbers is through the side near the bottom and ties into the same header as that of the inlet. Gate valves are introduced in the header line so that the flow of gas into the scrubbers may be in either direction, through one or both scrubbers in parallel or through both scrubbers in sequence, or directly into the holder line. The illustration of the wash box and scrubbers shows these connections very clearly.



View of Operating Floor, Showing Pumps, Turbo-Blower and Lampblack Infiltration Tanks.
View of Operating Floor in Opposite Direction.
View of Operating Floor, Showing Pumps and Compressors.

The wash box and scrubbers are designed to handle 80,000 cu. ft. of gas per hour.

There is a 2 in. hot water line connecting through valves at every point, where tar may be deposited.

Beyond the scrubbers the header line is 14 in. in diameter and makes a right turn through a + fitting to provide for connection to a future holder. At this point is a water column gauge to indicate pressure and a 1 in. line is carried back to the operating table to indicate to operator condition of green gas. The line, which is supported 3 ft. above ground, passes between the holders. There is a branch directly into the small holder; another branch, which divides, one leg connecting into the feeder line from the old plant generators and thence directly into the large holder, the other leg passing through branches to all purifiers, whose outlets connect into the old plant line to the large holder. There is also an underground connection (part of the old plant) from the small holder through the old purifiers.

Purifiers

The purifiers accomplish the final chemical clearing of impurities. The purifier installed with the new plant is of the tight-box type manufactured by the Baker Iron Works. It consists of a vertical steel cylinder with a conical steel cover, set in a concrete base. The operation consists of removing the sulphur (H_2S) content through the affinity of these gases for iron oxide. As this action ceases at low temperatures and is not efficient below 60 degrees, F., the purifying boxes are equipped with pipes for heating from the hot water circulating system. The iron oxide used is generally in the form of cast iron borings, which are allowed to rust, and these are mixed with pine shavings in order to give the mass porosity. Some care must be used in the filling material to prevent the introduction of chemical impurities, such as tannin and certain wood oils, detrimental to the operation. In this plant is used a prepared ferric oxide, known as "Ferox." The oxide is placed on grids, through which the gas is allowed to filter slowly. The new purifier has a capacity of 50,000 cu. ft. per hour, while the combined capacity of all of the purifiers is 80,000 cu. ft. per hour.

High Pressure System.

As all gas from this plant is supplied at high pressure, there is no use for exhausters. Gas is pumped directly from the holders by two compressors placed side by side on the operating floor. They are of the center crank and two flywheel "straight line" type, with steam and air cylinders in tandem, and are non-condensing, having been built by the Ingersoll-Rand Company, Class NF-1. The steam and gas cylinders are respectively 12 and 12¼ in. diameter, and the stroke 12 in., and the power rating is 60 h.p., with a capacity for compressing 310 cu. ft. free gas per minute, to a pressure of 60 lb. to the sq. in.

The high pressure gas is delivered into 3 in. gas-line wrought iron pipe, which is carried directly to the pressure tanks, being supported 8 ft. above ground on pipe columns with forked taps, all turns being bent and very gradual. There are four pipe lines, one from each of the four (including the two old) compressors. Three of these go straight through over the tanks to the outgoing transmission lines. There are two cross connections between the lines and the

tanks and a by-pass on the cross connection around the fourth feeder line. There are in this network 17 gate valves so placed that any combination of feed and supply may be made. This arrangement is well shown in the illustration. The pressure tanks are riveted sheet steel, mounted on concrete piers. Two of them are 5 ft., while the center one is 6 ft. in diameter.

Water Supply and Pumps.

The water pits are in the rear of the lampblack infiltrators and adjoining the operating floor. There are two driven wells, one 9 in. diameter and 78 ft. deep, while the other is 6 in. and 58 ft. deep. The overflow water from the scrubbers and also the filtration from the lampblack runs back into the water pits, so that but a small quantity of water must be pumped. There are two pumps, mounted on the operating floor for this purpose. The first is a Jeansville Iron Works, 4 in. Volute centrifugal pump, working to 90 ft. head, mounted on a cast iron base and concrete pier, and direct driven by a 15 h.p. style 122-C, 2700 r.p.m Kerr steam turbine. The capacity is 500 gal. per minute. The other pump is a Worthington duplex steam pump with 5x6 in. steam cylinders and 4 in. water inlet. This pump draws water from the wells or pit, while the centrifugal draws only from the pit.

Next to the water pumps are two duplex steam pumps, 6x4x6 in. and 6x4½x7 in. respectively. These are held in reserve and pump water into the system. Beyond these pumps are two Worthington duplex steam pumps, having cylinders 4½x2¾x4 in. These pump fuel oil from the storage tanks for use in the gas generator and under the boilers, there being an elaborate system of piping for these purposes. The remaining two pumps are of the same type as the last named, having cylinders 5¼x3½x5 in., and these operate in duplicate, pumping feed water to the boilers.

Blower.

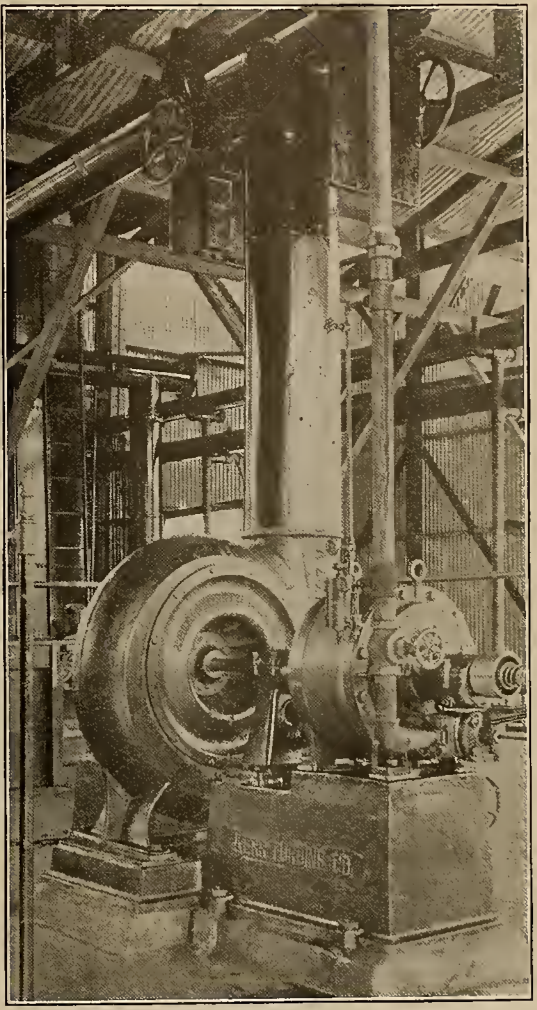
The remaining piece of apparatus on the operating floor is the blower, supplying the blast for the generator. This machine consists of a centrifugal blower made by the American Blower Company, Style W-431, direct connected to a 45 h.p., Size No. 124, Kerr turbine, operating at 2800 r.p.m. This rig has three bearings, is mounted on a cast iron base, which in turn rests on a concrete pier. A 15 in. outlet pipe delivers air into a header in which are placed two flat disc valves.

Piping.

One of the noticeable features of this installation is the elevated and exposed piping system. All piping, steam, air, water, oil and gas, are carried above the floor level, and in many cases at an ample height to afford headroom clearance under the pipes. This arrangement is a feature in the simplicity and economic operation of the plant.

Lampblack Disposal.

It is not an uncommon sight in gas plants to see several men shoveling or otherwise handling the lampblack. In this plant the lampblack is delivered, filtered, dried and deposited in front of the furnace doors of the boilers without handling. It is all consumed under the boilers, and the furnaceman shovels it into the grates. Water from the wash box carrying the lampblack is brought through a 10 in. wrought iron pipe, 10 ft. above the ground level, and this pours the solution directly into the two infiltration tanks, being turned into one or the other as may be required.



Turbo-Blower for Furnishing Blast. Gas Generator in Background.

Each of these tanks is 32 ft. long, 9 ft. wide inside, and 4½ ft. deep. They are built much like a mountain water flume, and are supported on posts and sills. The bottom of the tanks have longitudinal sills, on which are 2x4 in. cross sills or joists, spaced about 2 ft. apart. On these joists is a layer of ½ in. mesh galvanized iron netting, made of No. 12 wire. Placed on the netting is a layer of ½ in. crushed rock, 4 in. thick, and on top of this a layer of lampblack is allowed to remain, about 2 in. thick. The lampblack and water are deposited on this base and the water filters out by gravity and runs into the water pits over a concrete drainage floor under the tanks.

On the inside upper edge of the tanks, on either side, is a track, and this affords a runway for the four wheels of a flat scoop which moves the length of the tank. The scoop is made of planks and sets across the tank, completely filling it; it is hinged to and hung from a structural steel carriage, which is hauled back to the rear end of the tank by two steel cables. In operation, the scoop, which swings outward, is moved back over the accumulation of lampblack. It is then

drawn forward, when it assumes a vertical position, shoving a load of lampblack before it, which is deposited into a bin in front of the furnaces. Across the bins of each tank is a shaft with two windlass drums, on which are wound the steel hauling cables which pass under the tanks through pulleys and return to the scoop, while the other end of the cable is also fastened to the scoop frame. Both winch shafts are driven through reduction gears from a counter shaft on which is a shifting clutch to connect to either side. The counter shaft is driven through a chain by a 5 h.p. marine type reversing steam engine mounted on a platform between the tanks. When the lampblack is exhausted in the bins, the furnace man starts the engine and scoops a new supply from either or both tanks.

to the variation in the heat with consequent shrinkage in cooling. It is the custom to total the amount of gas which passes through meters and the amount of gas lost in transmission by leakage or contraction. It is estimated under the head of "unaccounted-for gas," although different gas men calculate this in various ways. During the month of September last the unaccounted-for gas was estimated at 16 per cent, of which 3 per cent was due to condensation.

One man, known as the "gas-maker," is required for the operation of the generator. In making gas, the blast, which heats the checker work within the machine, is run for a period of 10 minutes. At the end of this time, the gas-maker shuts off the blast, closes the stack valve and opens the make nozzles. Gas-making occupies a period of 20 minutes. This operation is immediately repeated, thus requiring one hour for a run. The making is stopped when the generator cools to a point where gas ceases to form properly. This is indicated by the appearance of oil on the water running from the scrubbers, and the lampblack stops forming. No pyrometer is used to indicate heat condition, as the interior temperature of the generator varies from point to point.

Boiler Room: Boilers on Left, Lampblack Bins on Right.

Characteristics and Operation.

The gas made at this plant is an oil gas with a heat value of 600 B.t.u. per cu. ft., and gives 18 candle power with a 4 cu. ft. per hour open tip burner on the bar photometer.

The oil used for fuel and gas making purposes is known as Union special fuel oil and is 24 gravity test on the Baume scale. This oil is treated by the producers to obtain a low sulphur content, which averages one-half of one per cent. A slightly higher price is paid for this oil over that of untreated oil to obtain this advantage.

The cost of oil at the plant is 70 cents per barrel, a saving of over 30 per cent over the price paid by the older companies.

When the plant at Porterville was taken over, there was required 22 gallons of oil to produce each 1000 cu. ft. of gas. The old Visalia plant required about 18 gallons oil for each 1000 cu. ft. of gas at the consumer's feeders. The present installation is delivering gas with the consumption of about 12 gallons oil per 1000 cu. ft. of gas. Of this 3 gallons is required by the boilers in operating the compressors, pumps, etc., while the remaining 9 gallons is supplied to the generator in blasting and making. This is said to be a remarkable record for an installation of this size and speaks well for the efficiency of the plant. It is a curious fact that there is no absolute way of determining just what quantity of gas is made at the generator, due

This plant is operated by two men on each of two shifts—a gas-maker and a fireman. This is another result of economic design and operation and is not often equalled in plants of this size.

Under the present demand the small holder is held in reserve. It is proposed in the near future to fill it simultaneously with the larger holder by properly adjusting the weighting of the lift.

The Transmission System.

The piping system which takes the high pressure gas to the various points of distribution is in three separate and distinct lines and supplies all of the principal towns in Tulare County. These are known as the Visalia, Tulare and Porterville lines, these cities being the terminal points. The present installation represents the beginning of a network which will radiate from the plant at Visalia and eventually extend north and west, while branches from the present lines to supply districts to the south and east of those now supplied are planned for construction in the future.

The Tulare line has been in place for about 5 years and formed a part of the old Visalia system taken over by the present owners. This line was built in accordance with practice which has been in vogue for a decade past, but in this instance its operation has pointed to the possibilities of improvement which have been embraced in the design of the Porterville line.

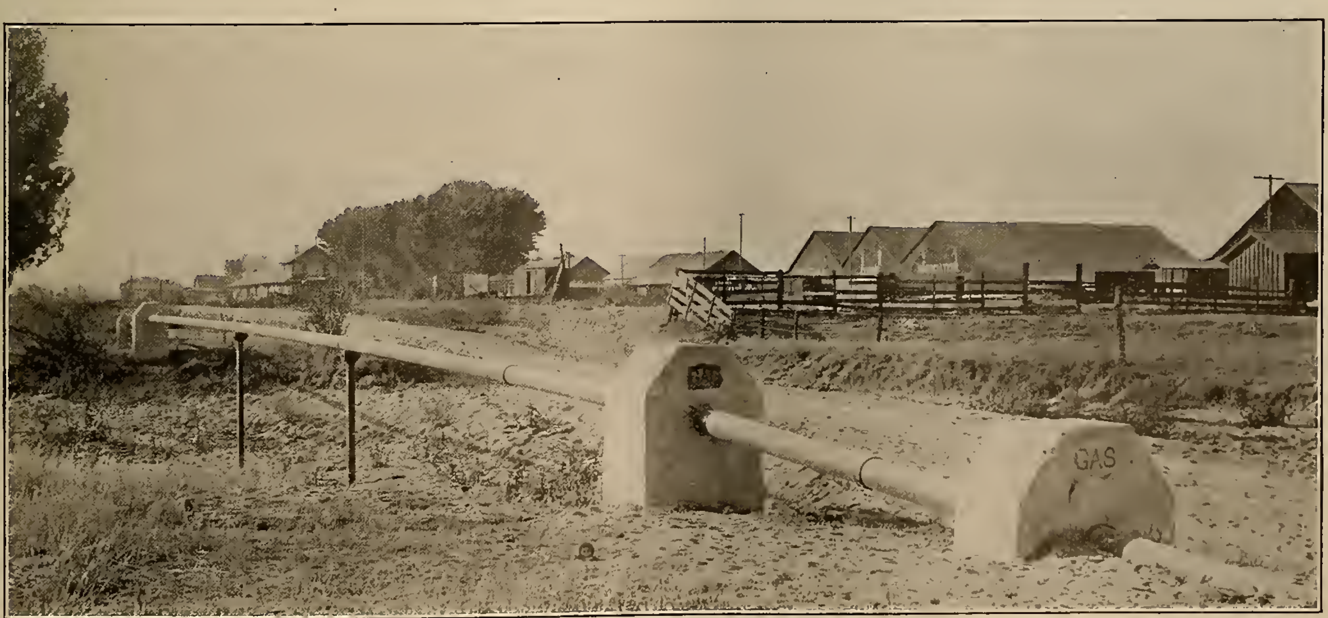
The line from Visalia to Tulare has a length of 8.9 miles. After leaving the pressure regulator the line parallels both the Visalia local feeder and the Porterville line, all of which are placed under the street, the line passing through the street manholes, but without valves or interconnection, until the southerly limit of the city of Visalia is reached. Here interconnection is made through valves with both other lines, to be used only in emergency. The line now turns at right angles, following a street and eventually a county road for a short distance, when it again turns south, following a county road until about one mile due east from Tulare, when the course is westward into that city. In following the county roads, the pipe is buried an average of 2 ft. below the surface and about 3 ft. outside of the fence line, which places it well away from the traveled part of the highway. A franchise from Tulare County affords the right of occupation and maintenance. This line consists of high pressure gas-line, lap-welded steel pipe, 2½ in. diameter, tested to 1500 lb. per sq. in. Tapered screw joints are used and a straight sleeve coupling. In laying this line no protective covering was used where the pipe is exposed, as in crossing ditches or water courses. While there has proven to be little danger from mechanical damage to the line, there is a variation in temperature of the pipe where exposed which has the effect on the gas, while passing a section where there is a sudden change in temperature, of causing naphthalene to be formed by condensation. This product, which is a flaky crystalline hydro-carbon, is to be avoided, as it is the cause of obstruction, lowering the efficiency in transmission by incrustation and is one of the principal sources of annoyance in operating a gas line. While these exposed sections are short and relatively few, the proper protection from trouble by this cause has been taken in the construction of the newer line.

There being but one principal point of distribution on this line, pressure regulation is accomplished at Visalia, the pressure being maintained at 30 lb. per sq. in. After entering Tulare the line follows a main cross street. At the entrance of the city proper, two branches take off in opposite directions, these forming two loops which join the straight through line at its terminus. The service pressure is maintained at 4 in. water pressure. Meters and regulators are similar to those used in other parts of the system, which are described elsewhere.

The Porterville line represents a modern practice of gas transmission for pressures and distances as presented in this system. As there are five points of distribution, individual regulation for these points is used by placing a pressure regulator at each point.

The line after leaving the right one of the three pressure tanks at the central plant, follows both the Tulare line and the local distribution, passing through the junction manhole to the crossing of the Atchison, Topeka & Santa Fe Railway, thence along a county road for ¾ of a mile, after which it takes to a county highway going easterly for 1½ miles, then south for ½ mile, then east, keeping the north side of the road, a distance of 6 miles to Exeter. In this 6 mile tangent, the line passes through the town of Farmersville. After passing the length of the main business street of Exeter the easterly direction is maintained for 1 mile and then the line takes a southerly direction which is followed for 6 miles to a turn to the eastward when a distance of one mile reaches Lindsay. The line passes around the business section of this city, reaching it through cross feeders, thence continuing ¾ of a mile to the eastward, whence it again turns south, following the county road for 4 miles through the town of Strathmore, thence following the Southern Pacific right of way for 2½ miles until the boulevard into Porterville is reached, which is followed for 2½ miles into the city of Porterville. The line is taken directly to the old gas plant, where connection is made through a pressure regulator into the Porterville distributing system.

This system consists of a loop around the city with cross branches and a line through the principal business street. This loop is constructed in the con-



Creek Bed Crossing of Transmission Line at Porterville.

ventional manner having been used by the old plant, now not in use but held as a reserve. As at all other points, individual service regulators are used. The connection with the plant at this place is such that the holder, which has a capacity of 10,000 cu. ft., may be filled from the pipeline; in case of emergency it is possible to draw this storage obtaining the proper pressure by means of a steam driven compressor which has a capacity of 10,000 cu. ft. per hour to the transmission pressure.

Typical Transmission Line Crossings: Irrigation Ditch (Upper); Packwood Creek, near Visalia (Lower).

The old generating plant in Porterville is enclosed in a corrugated iron building. It is equipped with one Western type generator having a capacity of 7,000 cu. ft. of gas per hour. The gas from the generator is delivered through a vertical drum wash box to two scrubbers, each 14 ft. high and 3½ ft. diameter. In a separate room is a 45 h.p. horizontal tubular boiler and the compressor above mentioned. This plant is in condition for use in emergency, but being of an old type, would not show the efficiency or economy in operation that is possible by the central plant, but would maintain service in the event of interruption in the transmission line.

The Porterville line was built by the company. When it was decided to make this installation bids were called for from engineering construction companies. It was found that the company could build this line for about 11 per cent less than the estimates from contractors, either on straight bid or by the cost-plus-fixed-percentage plan. The general design and construction represents the best thought and practice in gas transmission of this type, and operation for six months in supplying the territory throughout the length of the line has proved eminently successful.

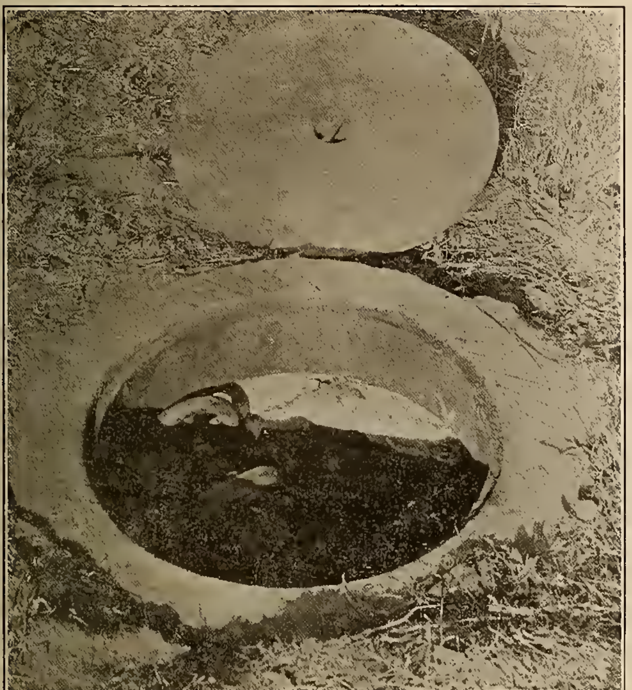
The total length of the line to the Porterville auxiliary plant is 32 miles. This line throughout is 3 in. special gas-line lap welded wrought iron pipe, tested to a pressure of 1500 lb. per sq. in. and weighs 7.54 lb. per ft. The ends have tapered screw threads, while the couplings having corresponding tapers and the ends are recessed so that the joint may be caulked. While the line pressure is but 30 lb. per sq. in., an extra strong and high grade pipe is desirable purely from mechanical considerations. The danger of leakage from splitting or cracking is obviated and with a high pressure gas line such precaution is of the utmost importance. This pipe was furnished by the U. S. Steel Corporation. In location the pipe is placed at the side of the road, about 3 ft. from the fence line, although this distance varies according to the topography on the ground surface. The average depth is 2 ft. In laying and screwing up the line a special style of lay-tongs was used. This has a grip similar to a Stillson wrench, but with the movable jaw brought to a flat point. They are built to take this size of pipe only and have a handle about 6 ft. long. These tongs were found to be very serviceable in handling this work.

The particular features of the line are the manholes, great number of valves and flanged unions, method of crossing watercourses and low ground and the protection at these exposed points.

There are 72 manholes in the length of the line. These were placed wherever there is a flanged union or a gate valve. The manhole serves not only as a protection but makes it possible to locate a union or valve quickly, a thing which might be a matter of some difficulty where the location of the part in question may be thoroughly obscured by brush, grass or other rank growths. Manholes are simple and inexpensive, having no bottom paving apart from the earth of the excavation tamped level and smooth. The sides are circular, about 30 in. inside diameter at the bottom and built of common brick laid up with cement mortar. The side wall tapers to the top on which is placed a cast-iron frame 22 in. diameter overall, within which is a flush fitting cast-iron cover, 18 in. diameter. The depth varies from 2 ft. to 6 ft., depending upon the depth of the pipe below the surface. Manholes are placed at or near one end of every crossing over a watercourse, where the span is over 6 ft. and also at regular distances where the line may be sectionalized. Of the 72 manholes, 28 of them contain steel screw-stem disc gate valves. These valves have tapered screw joints, but there is also in the manhole, separated by a short nipple, a flanged union. The remainder of the manholes contain only flanged unions.

The country traversed by the pipe line is, generally speaking, flat, although throughout this part of the San Joaquin valley, there is a gradual slope from the edge of the foothills of the Sierra Nevada toward the center line of the valley. The general trend of watercourses is west or southwest and there are many intermediate watercourses, some scarcely more than depressions and all of them dry for a large part of each year, and these are necessarily crossed by county roads and hence must be crossed by the pipe line in question. During the winter or rainfall season all watercourses carry flood waters and the surface drainage and oftentimes a very innocent appearing depression may become a raging torrent. For this reason it is necessary to design a pipe crossing with a two-fold purpose of ample clearance, allowing flood waters

to flow unobstructed under the pipe and supporting the pipe at sufficient height to prevent any possible damage from floating objects and debris. To fulfill these requirements the pipe is usually raised from one to two feet at the center of the crossing, giving the pipe the form of an arch. Concrete piers are used to



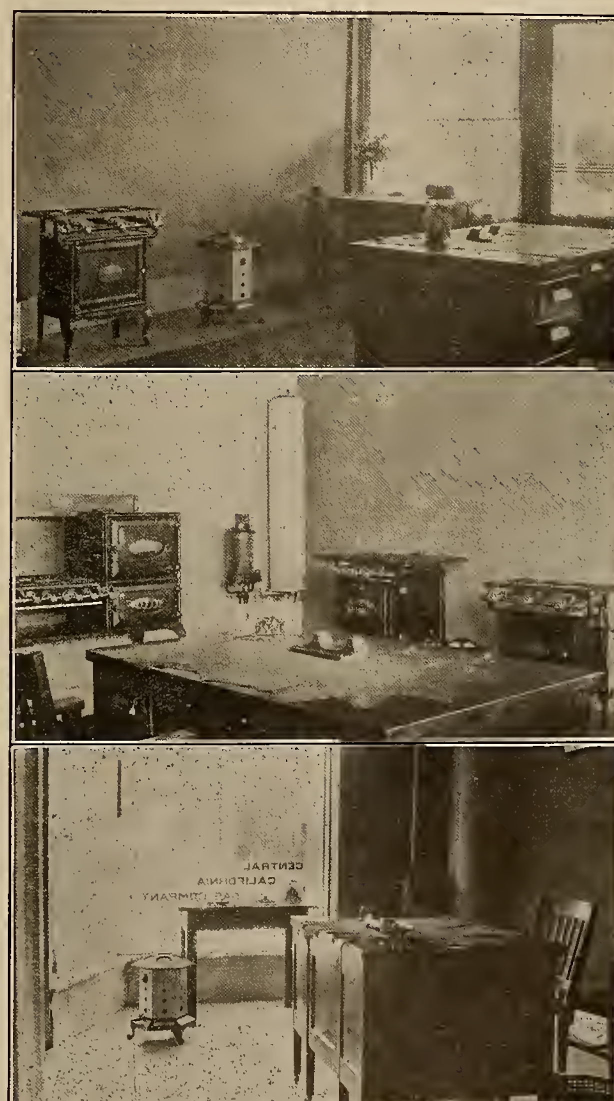
A Transmission Line Manhole, Showing Gate Valve and Flange.

maintain this position, these being similar in design throughout the line. The crossings vary from 6 ft. where a small irrigation ditch may be crossed to 250 ft. where the bed of a watercourse is unusually wide, although the road bridge may be much shorter. The concrete piers have a section 2 ft. wide and 1 ft. thick at the top, the sides battering slightly. The edges at the top of the pier are beveled to a 1 to 1 batter. The pipe, which passes through the pier on the center axis of its width is placed with its center 1 ft. below the top. The pier height varies with the topography from 2 ft. to 8 ft. and they are invariably carried into the ground to a depth which will give assurance of a stable foundation. In many cases a base of carefully laid loose rock is first put in, on which the pier is placed. In building the concrete piers, a simple movable form was used. The top of the piers are troweled smooth and the initials of the company indented thereon, while a rectangular recess was left on one side near the top, which was later filled with cement plaster and the word "Gas" in letters 4 in. high indented therein. Where the span is not over 25 ft., but two piers are used. For longer spans more piers are used, depending upon the topography. These are spaced 12 to 22 ft. apart with the exception of the main span which may be greater and in one instance this span is 56 ft.

For the mechanical protection of the pipe and also to maintain the temperature as nearly as possible constant and thus prevent the formation of naphthalene, from a sudden decrease in temperature of an exposed section, there has been slipped over the pipe at all exposed points, 6 in. diameter O. D. casing, a welded steel pipe. This protective covering has the added advantage of maintaining the arch curve of the crossing and preventing expansion and contraction of the transmission pipe due to temperature changes.

Wherever a distribution point has been established, a district regulator is used. These are Chapman-Fulton regulators, reducing from 30 lb. to 10 lb., and have a capacity of about 20,000 cu. ft. per hour.

At both Exeter and Lindsay, service mains are looped around the towns, with cross connections to the business section so that practically every house and store may have gas connection. Throughout the system service mains consist of 2 in. diameter, special gas-line wrought iron pipe which weighs 5.74 lb. per ft. Services are equipped with individual pounds-to-inches regulators. These were furnished by the Reliance Gas Regulator & Machine Company of Pasadena, Cal. The service conection is ¾ in., and the regulator will



An Interior View in the Visalia Office.
A Corner of the Visalia Office.
Interior View of Porterville Office.

pass up to 500 cu. ft. of gas per minute at 6 in. water pressure.

There are three district regulators in Exeter and two in Lindsay, while at Farmersville and Strathmore there are one each.

At a number of points along the line service connections are tapped directly, using a regulator for the proper reduction for service, in fact, the company is encouraging the use of gas for all purposes wherever a line can conveniently reach the customer and already many ranch houses are supplied with gas with which the houses are heated and lighted and cooking is done solely.

The third section of the distribution system is the local supply for the City of Visalia. The high pressure system is used in this distribution, a separate line being brought from the middle one of the three pressure tanks at the central plant. This line parallels the other two high pressure lines to the first or junction manhole, two blocks west of the plant. This is a large brick street manhole, about 4 ft. in diameter at the bottom and 6 ft. deep and has a cast-iron street cover. Within this manhole is a T connection and valve on a 2 in. branch line, and also a 30 lb. to 10 lb. pressure regulator. This branch forms a loop extending across the northern edge of the city and joining the next westerly crosstown line at its extremity. The local pressure line after passing through the junction manhole, still parallels the other two pressure lines, following the street southward until the second manhole, two blocks distant, is reached. Here again is a T connection with 2 in. outlet and reducing valve from which are taken two branches, each having valves, the one following the street east and the other in the opposite direction. The third and fourth manholes are spaced each two blocks from the last and the equipment is similar to the one just described. The high pressure line of the local system is 3 in. and similar to the Porterville line. The local distribution is uniformly 2 in. gas-line pipe and service connections are similar to those already described for other distributing points.

Tulare has a population of 3500 and is on the main line of the Southern Pacific about 10 miles from Visalia. Like Visalia it has an unusually well built business section which is surrounded by substantial residences, many of them of a high order, and the residence streets are wide and well shaded.

The towns of Exeter and Lindsay have not been in existence as long as Visalia or Tulare, and hence are not so large, their populations being 2400 and 3000 respectively. But both of these places are growing fast and give great promise for the future. They are both on the Southern Pacific and the former is on the Visalia Electric Railway. Both are heavy shipping points for oranges, lemons and other citrus fruits. The streets are wide and are rapidly building up with fine office buildings and stores, and the homes give every evidence that the great prosperity of this county has showered its share in these places.

Porterville is next in size to Visalia with a population of 4000. It is nestled in a most picturesque manner at the edge of the Sierra Nevada foothills with their highly cultivated orchards of orange and lemon trees. In the background, rising rapidly and seeming but a few miles away, the higher reaches of the Sierra Nevadas are tipped with snow peaks, one of which is Mt. Whitney, the loftiest summit in the United States. The main business street in Porterville is unusual for its width and fine appearance and wealth and prosperity is evidenced on every hand.

The total population served by the lines of the company is 21,000. Outside of the city and town limits, it has been the policy of the company to serve gas wherever it is possible to extend its lines to a customer. There are along the county roads and crossroads a population of 1400 which can be reached at present.

Since the new company has commenced service the growth in business has been phenomenal and while the field of opportunity has by no means been exhausted, there are now in excess of 3000 immediate customers, of which 2400 are being served.

The following table shows the number of meters installed:

	Population.	Meters.
Visalia	6,000	823
Tulare	3,500	383
Exeter	2,400	160
Lindsay	3,000	234
Strathmore	500	23
Farmersville	300	40
Porterville	4,000	423
	19,700	2086

The Main Business Street in Porterville.

Since the first of the present year, new business has at times come in faster than the generating capacity of the plant could provide for and already the first unit of the new installation is working to its capacity and will require extensions which it was not expected to have to provide for another year.

Main Street, Lindsay (Upper). A Business Street in Visalia (Lower).

The sale and use of gas using appliances is an indication of business growth. The company handle very complete lines of this apparatus at each of its offices with the necessary shop equipment to give the customer quick and efficient service. The customer's investment of appliances on this system will amount to $60,000. Since January 1st of the present year, the company has sold to customers over $17,000 worth of these equipments.

The company offices in the five principal towns are centrally located and in a way are unique. There are no counters and window gratings. Each office is tastefully finished and neatly furnished and carpeted and has the air and appearance of a well appointed private business office. The office manager has a flat-top desk and there is another desk for the convenience of customers with stationery, etc., ready for use. A few representative appliances are in evidence and altogether there is an air of cheerfulness and consideration for the customer which is generally appreciated.

LETTER TO THE EDITOR.

Nov. 18, 1913.

Dear Sir:—In your issue of October 11th, containing article "The Automobile in Modern Gas Distribution," permit me to call your attention to page No. 325, wherein it states, "Cost to Lay 300 ft. of Pipe." This should read, "Cost to Lay 100 ft. of Pipe." While the error is considerably in my favor, for which I most kindly thank you, nevertheless it is erroneous and should be corrected.

Yours very truly,

D. E. KEPPELMAN.

Superintendent Gas Department,
Pacific Gas and Electric Company,
San Francisco District,

THE DISTRICT AGENT.

BY W. R. NEELANDS.

(The author presents an interesting and complete exposition of the duties and responsibilities of the central station district agent. Mr. Neelands is District Agent for the Southern California Edison Company at Monrovia, Cal.—The Editors.)

To the question "What does business really mean?" Andrew Carnegie replied, "I would begin by saying that the root of business must always be service to the public."

The Southern Califonia Edison Company, in its business of generating, transmission and distribution of electric energy covers a large portion of the southern part of the state. This business field is divided into districts, and that the service to the public shall be maintained at all times at a high standard, the company has selected men who are called district agents, placed them in charge of these districts, and given into their hands the management of its valuable and important interests.

The district agent acts for the company in its intercourse with the public by virtue of his appointment, and he acts for the public in its intercourse with the company by his position, meaning that the permanent interests of the company and of the public are really along parallel lines.

In this dual position which he occupies, we will first consider the district agent's relation to the company. This is one of great responsibility. He is made the custodian of the company's property and the protector of its valuable investment and business—the property of the company in his district is under the general supervision and care of the agent, and he should know all that is going on, or being done in the way of changes, additions or extensions to this property. He should study to know the weak places, if there are any and be on the alert and able to act promptly should any trouble occur either from accidents or the elements. Not only are the plants, buildings and lines of the company under his care, but he is expected to keep his eye on the franchise rights to see that they are in no wise endangered. Having this in view, it is of the utmost importance that all matters affecting or liable to affect the company's interests directly or indirectly, should immediately be brought to the attention of the head office. He should not take it for granted that this or that will be known without his saying anything, but should promptly send an explicit report to the proper officer, and when his report has been made, and not until then, has he relieved himself of a certain amount of responsibility. Neglect of this is nothing less than unfaithfulness to his trust.

The district agent must at all times defend and advance the interests of the company. Expenditures should be carefully studied, and, before making any recommendation that entail cost, he should first say: "Would I advise this expense if this business were my own; will it give the return or prove as profitable as I would want it to?" If there arises a question in his mind it should be brought out, and higher authority consulted if the expenditure is asked for. The agent in his district is the eyes and the business judgment of the company. He can understand the local conditions better than the head office officials, and

so they must rely to a great extent on his knowledge and recommendations in authorizing an increase of investment in his district.

That the company may have a correct and full understanding of its interests, the district agent should work in perfect harmony with the various departments at the head office, and see that the weekly and monthly reports are forwarded with correctness and dispatch.

Eight years ago, in a paper read in the district agents' meeting of the company, the district agent as "A Business Builder and Developer" was discussed and special reference was made to the great problem which electric companies were at that time trying to solve—that of equalization. Showing the great investment, with a large annual charge for interest and depreciation, lying idle for practically eighteen hours out of every twenty-four, and of the six hours that were income producing there was about sixty minutes of peak, and it was this peak that added so materially to cost of operation. It was then urged that an active effort be made in the securing of paying business on the lines for the eighteen non-productive hours, and this was what all electric companies must aim at. The placing of electric appliances in the homes that the company served, and an active canvass to install the electric motor where the gas engine was then used, it was claimed would go a long way in securing the even load so much desired. How wise that admonition was we all now know, and I can easily believe that the writer of that article is himself greatly surprised at the developments made—the night peak having changed to a day peak with a good load factor. This should have but one result in the agent's relation to the company; an unswerving purpose to advance the business of the company along present lines and the development of methods for new business that will go to make for a still better load factor. The man who is daily in touch with that most spiritual of all agents—electricity—with its developments, will be a strange man if he is not stirred out of the humdrum of business life to give vent to imagination of possibilities which worked out are realized in actual results and later shown in the operating report.

The agent wlll not be afraid of the new appliance when he remembers that the iron which today is guaranteed for ten years and for life, had many weak points on its introduction. A few years ago his helpers were small in number. Today every member of every house the company serves is boosting for applied electricity, the best kind of advertising without cost. In my city last month there were no less than three short editorials in the daily paper crying out against the noisy gas engines, and that they should be displaced with the electric motor.

The live district agent should always take an active interest in all wise plans that stand for developing the community he serves, assisting by personal and financial effort as his time and means will permit.

As the agent's work in giving service to the public is naturally varied, he must cultivate broadness of mind and develop the finest character. Character counts. As our general superintendent once put it: "A man's proper worth to the company is not measured by gross earning or operating expenses, though these may have some effect on the length of his service, but his real value is measured by the esteem in which he is held in the community he serves. In other words, the final analysis, so far as the agent is concerned, is character."

The service the agent represents being that of a public utility, he will from time to time come in contact with the city council and several of the city's department heads. He should give them assurance that it is the company's will that he and all employes of the company carefully obey all ordinances of the city. As opportunity is given, he will show his friendliness and be ready to advise with them on any improvement considered for the city's good pertaining to the company service, showing that he is a good citizen as well as a business man. If this spirit is cultivated the agent's protest against any legislation that he believes will be hurtful to good service will have much greater weight.

The greatest safeguard against a community granting privilege to any rival public service corporation that a present company may have, is its popularity. Rival companies do not attempt war where the community is with the corporation already in the field.

The district agent must be on the friendliest terms with the business men of the community, frequently calling on them, making inquiry about the service and watching for opportunities to improve the lighting system of the stores, ever alert, as a wise salesman, to secure increase in business.

When in the office be easy of access and listen with the same attention and interest to a complaint as to a new power prospect. The man with a complaint, real or imaginary, should not be judged by that interview. For at this time he has a grouch and at all other times he may be the finest kind of a fellow.

The agent's personality will affect all the employes of the company associated with him, either for good or ill. It is well known that every business concern depends on the personal power of every man employed by it. It cannot make an exception of a single man or boy, woman or girl. Each has personal power to do the company harm or help it because of his or her contact with the public. A high standard maintained by the agent will, in a large measure, be copied by the employes, so he will carefully study the employes, especially those who are daily in contact with the public—such as the office force, the collectors, the troublemen, etc., for he knows the company demands the most courteous treatment and fair dealings to all customers. The company is giving service to the public, hence is a servant of the public, and each employe is the company in so far as he has anything to do with this service. Familiarity may breed contempt. but friendliness and courtesy on the part of the agent with employes and people will win the confidence and heartiest support of those under him, and the highest esteem of the community. The business world needs today more courteous, tolerant men. The cultivation of good manners—the manners founded on love and good will to fellow men will develop a magnet that will draw everything desired toward you.

The district agent can do no greater service for the

company and the public than in the securing of good men and their development. The company requires live wires overhead and underground, but also on the ground in the form of men of energy and adaptability—men who have storage batteries inside of them, so that they need not come to the agent for inspiration, but have the force in themselves to take up conditions that they may meet and bring results. Never be afraid to encourage and advance such an employe, even though you see the possibility of his going over you. They, in all likelihood, will go anyway, and the agent might better have the credit of giving to the company the man it has been looking for. The agent who in his service to the company and the people is doing his work well, and conscientiously, need never fear of losing his position to some other unless it is because of his own advancement.

It is but fair to the district agents of this company to say, they are loyal in their service to the company and the public, and it might be well to ask the cause of this spirit of loyalty? It is not the name, the Southern California Edison Company, but the personnel of the company. It is the men who are directing the affairs of this great corporation who appeal to us. We know them for their sterling personality and their spirit for the square deal to all their consumers—the public—and to the employes. Knowing this, we esteem and honor and feel ourselves favored in being identified with them. This same feeling, through the district agent, should in no small degree be what attaches the public and the employes in the districts to the company. As one business man said to one of our district agents, "I am glad to have known you and to have done business through you, for you have shown to me that there is one corporation that has a soul."

Sun-Power Plant Demonstration in Egypt.—A public demonstration was given recently of the workings of the sun-power plant erected by a New York concern at Meadi, near Cairo, in Egypt. The principle involved in the plant is the invention of Frank Shuman, an American, who supervised the erection of the plant and is conducting the experiments. The plant covers several acres of land on the west bank of the Nile. A series of reflectors and absorbers, a low-pressure steam engine, a condenser, and a pump comprise the principal independent units of the mechanism. There are five reflectors, each of which is 204 ft. long and parabolic in form. They are spaced in intervals of 20 ft., and made up of a series of ⅛-in. glass mirrors. The reflectors aggregate a total light absorptive surface of 13,500 sq. ft., are placed in iron frames, and geared and interconnected with the engine by an arrangement of cog wheels. The mirrors automatically follow the course of the sun, and are regulated by what is termed a thermostat, the secret of the invention.

Running exactly down the center of each reflector is the boiler or absorber, a box of ⅜-in. metal with a tube at the top. By means of an automatic feed the box is constantly half full of water. The reflected sun rays are concentrated on these boilers, and the steam generated is led from the various units to the engine. The 100 h.p. engine is of the low-pressure type. The exhaust is returned to the boilers through a condenser.

ELECTRIC SIGNS OF NEW YORK.

BY RUPERT BROOKE.

(The question is often asked, "Do people read electric signs," and the answer of those who have analyzed the question carefully is to the effect that the passer-by is bound to, for they literally burn themselves into our memory as indicated in this remarkable literary description of impressions of some New York electric signs. It is abstracted from a series of articles on "America," appearing in the "Westminster Gazette," London, Eng.—The Editors.)

Cities, like cats, will reveal themselves at night. There comes an hour of evening when lower Broadway, the business end of the town, is deserted. And if, having felt yourself immersed in men and the frenzy of cities all day, you stand out in the street in this sudden hush, you will hear, like a strange questioning voice from another world, the melancholy boom of a foghorn, and realize that not half a mile away are the waters of the sea, and some great liner making its slow way out to the Atlantic. After that, the lights come out up-town, and the New York of theatres and vaudevilles and restaurants begins to roar and flare. The merciless lights throw a mask of unradiant glare on the human beings in the streets, making each face hard set, wolfish, terribly blue. The chorus of voices becomes shriller. The buildings tower away into obscurity, looking strangely theatrical, because lit from below. And beyond them soars the purple roof of the night. A stranger of another race, loitering here, might cast his eyes up, in a vague wonder what powers, kind or maleficent, controlled or observed this whirlpool. He would find only this unresponsive canopy of black, unpierced, even, if the seeker stood near a centre of lights, by any star. But while he looks, away up in the sky, out of the gulfs of night, spring two vast fiery toothbrushes, erect, leaning towards each other, and hanging on to the bristles of them a little Devil, little but gigantic, who kicks and wriggles and glares. After a few moments the Devil, baffled by the firmness of the bristles, stops, hangs still, rolls his eyes, moon-large, and, in a fury of disappointment, goes out, leaving only the night, blacker and a little bewildered, and the unconscious throngs of ant-like human beings. Turning with terrified relief from this exhibition of diabolic impotence, the stranger finds a divine hand writing slowly across the opposite quarter of the heavens its igneous message of warning to the nations, "Wear ——— Underwear for Youths and Men-Boys." And close by this message come forth a youth and a man-boy, flaming and immortal, clad in celestial underwear, box a short round, vanish, reappear for another round, and again disappear. Night after night they wage this combat. What gods they are who fight endlessly and indecisively over New York is not for our knowledge; whether it be Thor and Odin, or Zeus and Cronos, or Michael and Lucifer, or Ormuzd and Ahriman, or Good-as-a-means and Good-as-an-end. The ways of our lords were ever riddling and obscure. To the right a celestial bottle, stretching from the horizon to the zenith, appears, is uncorked, and scatters the worlds with the foam of what ambrosial liquor may have been within. Beyond, a Spanish goddess, some minor deity in the Dionysian theogony, dances continually, rapt and mysterious, to the music of the spheres, her head in Cassiopeia and her twinkling feet among the Pleiades. And near her, Orion, archer no longer, releases him-

self from his strained posture to drive a sidereal golf-ball out of sight through the meadows of Paradise; then poses, addresses, and drives again.

> "O Ninevah, are these thy gods,
> Thine also, mighty Ninevah?"

Why this theophany, or how the gods have got out to perform their various "stunts" on the flammantia moenia mundi, is not asked by their incurious devotees. Through Broadway the dingily glittering tide spreads itself over the sands of "amusement." Theatres and "movies" are aglare. Cars shriek down the street; the Elevated train clangs and curves perilously overhead; newsboys wail the baseball news; wits cry their obscure challenges to one another, "I should worry!" or "She's some Daisy!" or "Good-night, Nurse!" In houses off the streets around children are being born, lovers are kissing, people are dying. Above, in the midst of those coruscating divinities, sits one older and greater than any. Most colossal of all, it flashes momently out, a woman's head, all flame against the darkness. It is beautiful, passionless, in its simplicity and conventional representation queerly like an archaic Greek or early Egyptian figure. Queen of the night behind, and of the gods around, and of the city below—here, if at all, you think, may one find the answer to the riddle. Her ostensible message, burning in the firmament beside her, is that we should buy pepsin chewing gum. But there is more, not to be given in words, ineffable. Suddenly, when she has surveyed mankind, she closes her left eye. Three times she winks, and then vanishes. No ordinary winks these, but portentous, terrifyingly steady, obliterating a great tract of the sky. Hour by hour she does this, night by night, year by year. That enigmatic obscuration of light, that answer that is no answer, is, perhaps, the first thing in this world that a child born near here will see, and the last that a dying man will have to take for a message to the curious dead. She is immortal. Men have worshipped her as Isis and as Ashtaroth, as Venus, as Cybele, Mother of the Gods, and as Mary. There is a statue of her by the steps of the British Museum. Here, above the fantastic civilization she observes, she has no name. She is older than the skyscrapers amongst which she sits; and one, certainly, of her eyelids is a trifle weary. And the only answer to our cries, the only comment upon our cities, is that divine stare, the wink, once, twice, thrice. And then darkness.

Electricity on James J. Hill's farm is to be quite a prominent feature. The new $150,000 mansion is being erected at North Oaks on a 7000-acre farm near White Bear, Minn., and will be equipped to utilize electricity to the fullest extent. Electric power will also be used for various farming operations, the total connected load amounting to about 65 h.p. Electrical energy will be supplied North Oaks by the Stillwater Division of the Consumers' Power Company, a Byllesby property. Prior to signing a five-year contract with the Consumers' Power Company, Mr. Hill had experts investigate the advisability of an isolated power plant, but eventually decided in favor of central station power.

A POWER FACTOR CHART FOR THE TWO WATTMETER METHOD WITH BALANCED LOADS.

BY JOHN WILLIAMS DAVIS.

The chart (Fig. 1) which is to be used for determining the power factors at which the different meters are operating when the power in a three-phase balanced system is measured by the two wattmeter method, consists of two curves.

Curve 1, the watt ratio curve, shows the relation between the aggregate power factor of the three-phase load and the ratio of the two wattmeter readings. This method of determining three-phase power factor by means of two wattmeter readings was given in an article by Nicholas Stahl in the Electrical World August 29, 1908.

The equation of the curve may be deduced as follows: Let the two wattmeters be connected with their current coils in lines A and C (Fig. 2) and their potential coils between A, B, and C, B respectively. Let the load be balanced and let the angle of the neutral voltages ahead of the line currents be represented by θ.

Let $q = \cos\theta =$ aggregate power factor.

$r =$ ratio of wattmeter readings.

Then $W_1 = I_a E_{ab} \cos(\theta + 30°)$.

$W_2 = I_c E_{cb} \cos(\theta - 30°)$.

$$r = \frac{W_1}{W_2} = \frac{I_a E_{ab}\,[\cos\theta \cos 30° - \sin\theta \sin 30°]}{I_c E_{cb}\,[\cos\theta \cos 30° + \sin\theta \sin 30°]}$$

$$r = \frac{\tfrac{1}{2}\sqrt{3}\,q - \tfrac{1}{2}\sqrt{1-q^2}}{\tfrac{1}{2}\sqrt{3}\,q + \tfrac{1}{2}\sqrt{1-q^2}}$$

Clearing of fractions and collecting like terms

$$\sqrt{1-q^2}\,(1+r) = \sqrt{3}\,q\,(1-r).$$

squaring

$$(1-q^2)(1+r)^2 = 3q^2(1-r)^2$$

$$q = \frac{1+r}{\sqrt{(1+r)^2 + 3(1-r)^2}} = \frac{1}{\sqrt{1 + 3\left(\dfrac{1-r}{1+r}\right)^2}}$$

Curve 2, which is an ellipse, gives the relation between the aggregate power factor and the power factor at which each of the meters is operating.

The fact that curve 2 is an ellipse was demonstrated by Professor William F. Durand of the Leland Stanford Junior University.

Using the same figure as in the preceding deduction we have the following proof:

$p_1 =$ power factor in wattmeter 1.

$p_2 =$ power factor in wattmeter 2.

$p =$ power factor in either meter.

Then

$p_1 = \cos(\theta + 30°) = \cos\theta\cos 30° - \sin\theta\sin 30°$.

$p_2 = \cos(\theta - 30°) = \cos\theta\cos 30° + \sin\theta\sin 30°$.

$p_1 = \tfrac{1}{2}\sqrt{3}\cos\theta + \tfrac{1}{2}\sin\theta$.

Denoting the aggregate power factor or $\cos\theta$ by q we have

$p = \tfrac{1}{2}\sqrt{3}q + \tfrac{1}{2}\sqrt{1-q^2}$.

$2p = \sqrt{3}q + \sqrt{1-q^2}$.

squaring

$4q^2 - 4\sqrt{3}\,pq + 4p^2 = 1$.

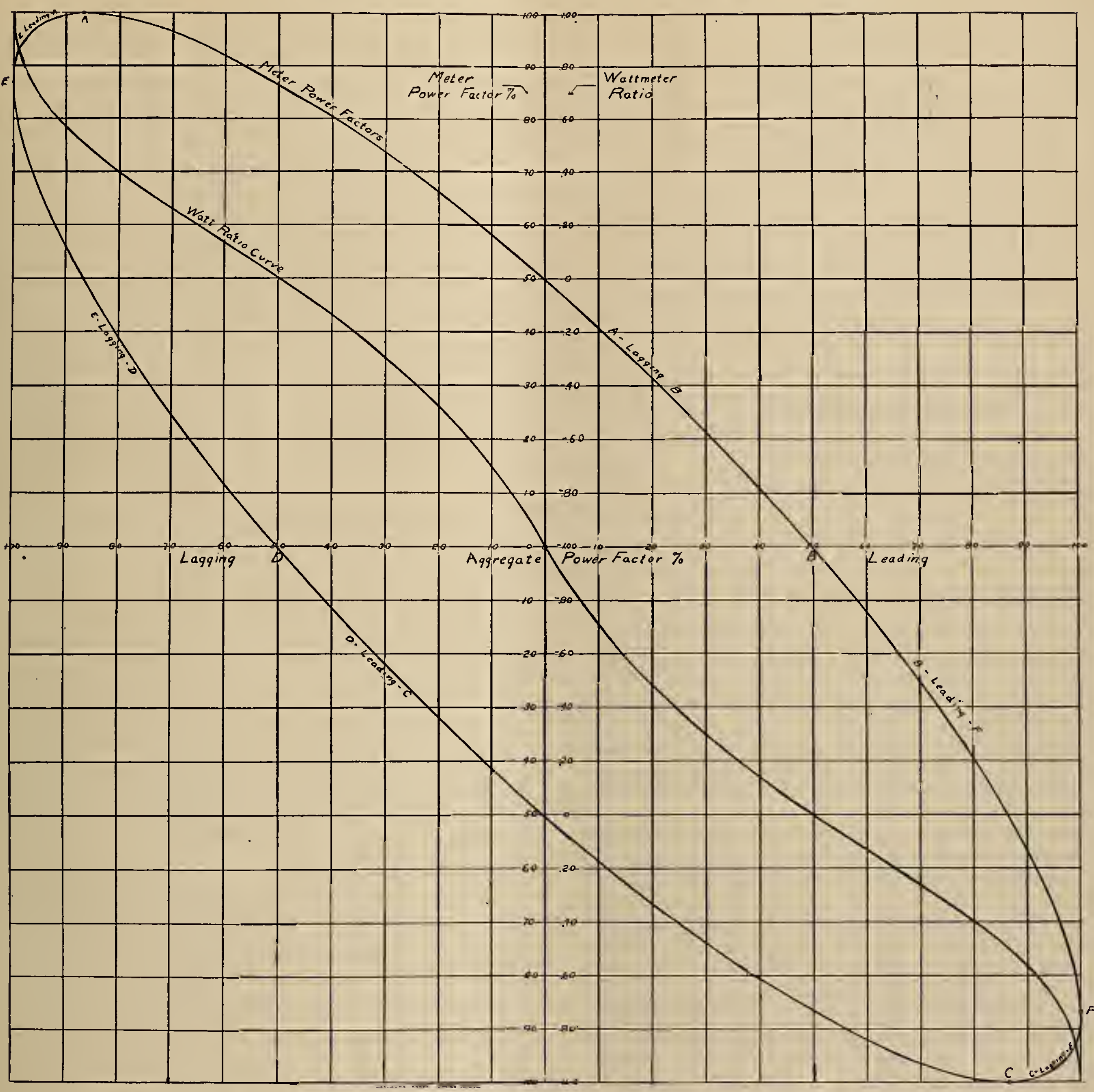


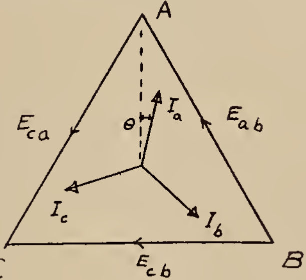
Fig. 1. Power Factor Chart for Meters Used in Measuring Power in Three Phase Balanced System by the Two Wattmeter Method

This is an equation of the second degree in two variables and it is easily shown that it is an ellipse with axes making an angle of 45 degrees with the p axis.

Application.

Suppose for instance that two wattmeters connected to a balanced three-phase load read 1000 and 400 watts respectively. Finding the point corresponding to the ratio of these readings (40) on the vertical scale we pass across to the watt-ratio curve and read off the aggregate power factor of .804. We now determine the power factor at which two meters are operating from the two points on the ellipse which correspond to this aggregate power factor. In this case the power factors are .993 and .398.

A knowledge of these power factors is useful in determining the corrections to be applied to the wattmeter readings as such corrections vary with the power factor as well as the load.



(Fig. 2.)

It is hardly necessary to say that these curves are equally applicable in determining the power factors at which watthour meters are operating.

PACIFIC COAST GAS ASSOCIATION.

(The following pages are abstracted from the discussions of papers at the Pacific Coast Gas Association Convention, which have been just made available for publication. The sub-heads are the names of the papers discussed, all of which have appeared in previous issues of this journal.—The Editors.)

Oil Gas.

E. C. Jones—Aside from the production of marsh gas synthetically, which has been proven possible up to nearly 44 per cent of the total consumption of gas, the fact that there is enough carbon remaining in the generator after the run—carbon in a finely divided state on the checker brick—to reduce the amount of oil used for heating one-half gallon per thousand is very well worth taking into consideration. Figure for a moment what that means to any city, small or large. In a city of ordinary size it would amount to several thousand dollars a month. Three or four thousand dollars a month may be saved by simply using a little care and applying this new method to the apparatus which you now have, whether you use what is known as the "straight shot" machine or any of the variations from that type of machine. The next point that is worthy of consideration is the question of spraying the oil into the machine. It is something that none of us have understood. We have experimented and have gotten results. But never have we known why we get these results. The results of spraying oil into generators are as contradictory and elusive as the operation of the steam jet exhauster. In the experiments covered by this paper we find that the only thing necessary to get perfect results is to maintain the velocity of the vaporized oil, meaning that if you vaporize oil through a quarter inch opening, from the liquid into a spray or fog, that the spray or fog must enter the generator to be converted into gas through a quarter inch opening. It does not matter if it is a quarter of an inch, or three-eighths of an inch, or an inch, as long as the orifice through which it passes into the generator is exactly the same size as the spraying or vaporizing orifice. The paper is well worth studying that we may get better results for our stockholders.

Standards of Quality and Service for Oil Gas.

E. C. Jones:—I have carefully considered the suggestion to have the matter of quality, standard and pressure, referred to a committee. For nearly a year the United States Bureau of standards at Washington has been engaged in the revision of what is known as circular number 32, having to do entirely with the standards of quality and pressure of gas. The American Gas Institute took this matter up a year ago and appointed a committee to confer with the bureau of standards and I happened to be a member of that committee. During the revision of the circular I was in communication with the chief of the bureau of standards at Washington, and the question arose—what shall be the proper heat unit standard of gas to be sold for any purpose? I am on record as advocating 550 British thermal units per cubic foot. European standards are even lower. Mr. Papst has suggested as low as 500 British thermal units and I believe be is right. But the country is not ripe for it at this moment. This is what will happen. When the chief of the bureau of standards at Washington asked me about reducing the standard from 600 to 500, he added a rider. He said, "Of course, there will be a proportional decrease in the price of gas." Now, that word "proportional" is the nigger in the fence. Stop and think. The public today does not realize the difference between the cost of gas and the selling price of gas. Some people cannot understand why gas cannot be sold at slightly above its cost in the holder. They do not realize the distribution expenses and the volume of the charges that go to make up the immense cost of maintaining the business. They think that natural gas might be given away because it comes from the ground, practically God-given, excepting the interest on the cost of the well and a few other things. This is what will happen. A reduction from 600 British thermal units to 550 is 8 1/3 per cent, 8 1/3 per cent of the cost of oil, taking oil at 68½c per barrel, and eight gallons of oil per thousand, is 1.08 cents per thousand. So that were you to reduce the heat units of your gas from 600 to 550 British thermal units, you could only afford to reduce the price of gas 1.08 cents, making your dollar gas something less than 99 cents. The public service commission and the bureau would expect you to reduce your dollar gas to 91 2/3 cents, which would be an injustice and would work a hardship on the gas companies. And at this moment it would be very hard to explain to the public what I have just stated. Undoubtedly a gas made free from heavy hydro-carbons is the best gas to use with incandescent gas burners or in any burner using an air mixer. For industrial purposes I think a 500 British thermal unit gas is ideal, but has the time arrived when we can reduce it and explain to the public that whereas we have reduced the heat units 8 1/3 per cent that 8 1/3 per cent cannot be taken from the cost of gas, but only on the cost of the oil in making the gas? So I would be a little bit slow in approaching this subject. The bureau of standards in Washington has consulted all of the districts geographically of the United States by writing to the different gas engineers and men who have their hearts in the business, to find out what they wish in the matter, and they try to follow along these lines, at the same time trying to do their strict duty to the public.

In the question of pressure, it is unfortunate that eastern commissions are advocating maximum pressure at which gas should be delivered. The New York commission has fixed a maximum pressure and a minimum pressure. The bureau of standards at Washington advocates 6 inches as a minimum pressure. This should not be so. A gas company will not deliver gas at any greater pressure than it has to, because the gas company is the only sufferer. The consumer has the regulation of the gas pressure between his thumb and finger by merely turning the stopcock, and he can shut the pressure down to any point he likes. Besides, he has an extra check by putting in a house governor if he pleases and thus reduce the pressure to any standard he pleases. But when the company raises its pressure it increases its leakage. The consumer should understand the advantages of high pressure. When the company increases the pressure it gives the consumer any quantity of the commodity for any kind of use, and at the present day it is sometimes desirable to have a very large quantity of gas through an ordinary sized pipe in a very short period of time. I think it will land us here: That in the near future the maximum pressure requirement will be removed, and it will reduce itself to the introduction of a house governor tor every consumer. Then we will find, with the introduction of incandescent gas burners, medium pressure burners, and the use of gas for industrial purposes, that the consumer will realize the advantages of high pressure, and he will not put in a governor but will have it removed if he has one. I think we as individuals should post ourselves as to the advantages of high pressure—as an advantage to the consumer and not to the company. Of course, the company reaps some little advantage in the greater carrying capacity

of its mains. But we should be ready with an answer to the question of how much more efficiency do we get out of an appliance with 8 in. pressure than we do with 6 in. pressure, and then the consumer will adopt the higher pressure and reap the advantages of it.

John A. Britton:—It may be interesting to give the members the rules adopted by the railroad commission of Wisconsin no later than August 9th of this year in passing on the question of the testing of meters, and the time of life permitted to a meter in place. It is given at 48 months. In San Francisco we allow it to remain for 60 months. It goes on to determine the required heat value and it fixes the maximum in that state at 600 and the minimum at 550 under the ordinary standard conditions of temperature and pressure. "Gas pressure, as measured at the outlet of the company's service to any consumer, shall never be less than 2 in. nor more than 6 in. of water pressure, and the maximum pressure at any such outlet on the system shall never be greater than double the minimum pressure at that outlet."

"In no case shall the gas contain more than 30 grains of total sulphur per 100 cubic feet, and not more than a trace of sulphur as sulphuretted hydrogen."

They have gone to that very low pressure which would be entirely inadequate in our state, and I agree with Mr. Papst that the states of the Pacific Coast should take action.

Modern Gas Distribution and the Part Played by the Automobile.

Leon B. Jones:—The only portion of Mr. Kepplemann's paper that I am at all fitted to discuss is the welding portion. Since my paper last year in which I brought out a few of the facts of the work with the method of oxy-acetylene welding, Mr. Kepplemann has brought it to such a practical state of perfection that today every foot of high pressure installation in San Francisco is done by the oxy-acetylene process. That not only applies to the high pressure mains, but it also has been brought in quite recently in the connecting of manifolds for installing large meter connections in apartment houses where there are two or three hundred meters set and where it necessitated expensive fittings. That is, where a 4 or 6 in. manifold would be used, every meter would require 4 or 6 fittings and a 1 in. tee for an inlet and outlet. Now, the manifolds are straight pieces of pipe in which a hole is drilled and the meter connection is shoved up into the manifold. In that way the expense of making these connections is eliminated. In that way welding has not only taken its place in the field of high pressure distribution, but in the shop work all the details of labor have been eliminated to such an extent that it is now considered a necessity to the distribution department.

E. C. Jones:—I want to tell you of a piece of work done by Mr. Kepplemann under trying conditions. We have had, as you know, troubles with our help in the gas company resulting in a strike which has probably been the most extensive strike in any gas or electric company in the world. A few nights ago a telephone message came in between 1 and 2 o'clock in the morning that there was a high pressure leak on the outskirts of San Francisco near the county line between San Francisco and San Mateo county. In 20 minutes after the word was received by Mr. Kepplemann he was on the job with a gang of men and found that three holes had been punctured into the 6 in. high pressure line carrying 75 lb. pressure. The gas had been ignited and the flames from the holes extended to a height of probably 25 ft., uniting at the top into one fan-shaped flame, illuminating the entire neighborhood, and the roar of the fire could be heard for blocks. The work was done by miscreants who made use of the substance known as thermit which has been extensively used for the welding of cast iron and steel. The thermit was placed on top of the main in four places, close together, and ignited, burning holes through the steel pipe, and as the gas issued from the hole it ignited. One of the holes failed to work. Three of them ignited, causing an immense loss of gas and it seemed when I got on the ground that it was really a tough job to put out the fire. The line which had been tampered with supplies the southern portion of San Francisco with high pressure gas and also all the towns on the peninsula, extending as far south as Palo Alto, and it was impossible at 2 o'clock in the morning to shut the pressure off the line, having on it thousands of consumers with water heaters and pilot lights, bath room lights and all manner of night lights, which it would have been a crime to have extinguished. The question arose, how should we extinguish this flame, because without putting it out it was impossible to stop the flow of gas and to make repairs. Mr. Kepplemann sent an automobile truck into the city yard and got a length of 6 in. steel tubing 20 ft. long, with some rope, and placed the tubing on the ground at right angles to the holes, the holes being three-quarters of an inch in diameter. We reduced the pressure from 75 to 50 pounds on the line, knowing that this pressure would carry with perfect safety. Guy-ropes were fastened near the other end of the 6 in. pipe for the purpose of raising it to a perpendicular position. It was raised by these guy-ropes until it stood directly on top of the 6 in. pressure line and enclosed the leaks. It only took an instant to stop the fire at that point because of the impossibility of air getting to it. So after the 6 in. pipe dropped on the flame at its smallest point at the bottom, in a second the flame shot from the top of the stand-pipe and the moment it was seen that all the flame was coming out of the top of the stand-pipe, word was given to let go of the guy-ropes and the pipe was thrown clear of the high pressure line, carrying with it the flame. The gas flame issued from the end of the 6 in. pipe on the ground for half a second or maybe a full second and burned the gas that was in it, but the flame from the high pressure line was extinguished. We then had some soft pine plugs 4 ft. long prepared and driven into the holes and cut off, and the pipe was bandaged with three-inch tape, something similar to tire tape, till the gas leak was entirely stopped. The pressure was then raised on the line and no consumers knew that there had been trouble of any kind. In fact, there was no interruption of the service. I mention the fact to show the necessity of having quick means of getting to a job. Twenty minutes from the time the police reported this leak, our men were there with automobiles and it took but a few minutes more to go into town and get the length of pipe and the ropes and bring them out on the job. It could not have been accomplished with horses.

Another thing I want to call your attention to is the necessity for the employment of resourceful men. A man of the calibre of Mr. Kepplemann can save his salary in a very few minutes. I have often been asked how to put out a gas fire on a high pressure main. I believe I have suggested a half dozen methods and none of them worked, but this simple little thing turned the trick. If you ever have any trouble of that kind simply stand up a pipe and take the flame away. It doesn't matter what the diameter of the stand-pipe is. It may be 6 or 8 or 10 or 12 in. pipe. Any pipe that you can handle freely. Be careful not to burn your men. Don't use a coated pipe. But any size pipe will trap the flame and take it away from the leak. I want to compliment Mr. Kepplemann on his splendid paper. It is impossible to read a paper of that kind and have it thoroughly understood. I am sure the tables and illustrations will remain companions to you for years. He has calculated the cost of doing various jobs and his averages cover such a quantity of pipe that the error has been minimized and you will find the paper has valuable data as to the calculation of cost of laying mains and renewing pavements and other factors connected with pipe laying and the care of pipe.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Intensive Expansion

Some central stations are alert to the necessity of inducing industries to locate favorably to their distribution systems. Wheels locked for the greater part of each day allow too much waste. The idle investment is a loss. This naturally results in a higher charge for the energy supplied and so makes the securing of new business more difficult.

Lack of business causes lack of ease, and contrary to the usual order this disease is thought to be from without rather than within. Some commendable cures have been concocted for this condition and others that are wide the mark, but all seem to suggest the saturation of the system with something new. But the need of improving load factor has not been sufficiently emphasized, and even where recognized has not been completely carried out.

Immediately there comes the counter suggestion, why study load factor when there is so great a surplus capacity? And the answer is time worn, but still true, "It is more profitable to improve load factor and hence the earning capacity of existing lines, than to extend to new business."

Every restaurant in your territory may use electric fans and you are probably proud of that fact, but has every restaurant an electrically operated dishwashing machine, vegetable peeler, refrigeration outfit or the many other power using devices which your experience will suggest? Have you taken full advantage of the improved electric vehicle opportunity? It is safe to reply, "No!" The same is true of other classes of business.

By close co-operation in any locality the electrical industry could increase business for all. Even so-called slack times should have a beneficial effect upon a business which provides invariably the more economical way. It is largely up to the central station.

The utilization of surplus power together with improved load factor and production at a cost which permits competitive selling, hinges upon willingness to make a comprehensive study of existing customers' requirements and an endeavor to completely fulfill them. They indeed profit most who serve best.

Part of the hazard of centralization consists in possible neglect. A small community served by a local steam plant may enjoy excellent service and attention. The coming of the larger corporation's distribution system annihilates or otherwise eliminates the local plant and while the community may be given a lower rate for the energy delivered it really costs more if the attention and care of their interests is neglected. Probably the larger system thinks it necessary to only send out monthly a man to read the meters and bill the consumers, for perfection of system and automatic operation exclude the human element—the corporation's real expression of service. Of course, all communities are not small and local agents may be installed, but they are not legion who measure up to the splendid standard stated in the article on The District Agent which appears in this issue. Even where a good agent is appointed he is often handicapped by rules and regulations and limitations made by men who do not understand, and so he is unable to carry out the plans he finds necessary to good service.

But by improving conditions through a more com-

plete service which really serves, you improve load factor, grasp Opportunity and so restore ease. The result is intensive expansion and growth which is self-sustaining.

Protecting the Stranger

Everyone eager for the success of the Panama-Pacific International Exposition, 1915, appreciated, at the time of its passing, the Kahn Law providing for the free importation of articles intended for foreign buildings and exhibits and for the especial protection of the foreign exhibitor against the unlawful appropriation or reproduction in the United States of his invention, copyright, trade-mark, and so forth.

Except by perhaps a few expert patent attorneys it was not thought that this protective measure menaced the safeguards afforded by the general laws to domestic inventions, patents, copyrights and trade-marks. Such, however, is now found to be the case, although the law is in force, having been approved last September.

In its passing, it is stated that time was not taken for it to be submitted to the Patent Committee of either House of Congress or to other authorities which should have been consulted.

Apparently simple in itself and necessary to the success of the Exposition the Kahn Law makes a sieve out of existing laws and good and makes them of less effect.

The Committee on Laws and Rules of the Patent Law Association of Washington brand this "the most dangerous, ill-considered, and inexcusable law ever enacted," in this connection.

Under our general laws foreigners have the same opportunities as our citizens to obtain patents for inventions, designs, copyrights and trademark protection. While this new law which conveniently knocks a breach in the tariff wall for the more convenient entrance of exposition things, might have provided additional facilities to foreigners temporarily seeking protection it is thought that a new law and additional rights were unnecessary.

The ramifications of these patent and copyright laws are so intricate and their construction extends over so large a number of years that hastily enacted new laws on this subject seem incongruous.

Things done in haste usually have to be done over again and it is urged that pressure be brought to bear upon Washington so that this law be immediately amended. That the necessary revision will be made is a foregone conclusion, for while the stranger, or rather guest within our gates—exhibition or otherwise—must be protected, yet there is no valid reason for inflicting even a possible hardship upon legitimate domestic enterprise while generously extending that protection.

Law continues only by consent of the people, and in the last anaylsis, by virtue of what is reasonable in its demands.

It is a question whether a law which protects on the one hand and unduly persecutes on the other could be long enforced, but where the danger of injury, endless litigation and entanglement is foreseen, immediate action should be taken to restore confidence.

Double-Deck Cars

Some people are unfortunate in that they travel on street cars only during "rush" hours. "The traffic peak," they are told, "makes it impossible to supply seats for all," and so they ride standing. But strap-hanging by tired people causes discontent. This is ultimately expressed in an upheaval which occasionally results in municipal ownership. A duplicate system or additional cars are then provided, but in a comparatively short while, custom conquers and the strap-hanger is again in evidence. Peak-load traffic is so elementary, so general an annoyance to all, that it is a wonder why people imagine that a change in ownership or administration will ameliorate this untoward condition without a change in plan.

A seat for every nickel is an essential of good service.

It has been an accepted theory in the past that peak-load traffic prevented the realization of this ideal, but by combining one discarded type of car with a new idea this seat-for-all theory is not only practicable, but should prove an advantage to the transportation company also.

The arguments advanced against the adoption of double-deck cars, which are in general use throughout Europe, hinged upon the difficulty of making a quick start at the many stopping places we have for accommodation. "The conductors would be at various points either within the car or on the upper deck and accidents also would be of more frequent occurrence," ran the arguments.

Accepting these views as actually borne out by analysis, and the argments, now fail absolutely due to the practically universal adoption of the pay-as-you-enter type of car together with the push-button system of signalling the conductor.

A prepayment type of double-deck car with enclosed ends, outside safety doors, but no interior bulkhead doors, together with an efficient system of electric bell signalling would satisfactorily solve this problem and at the same time aid in relieving traffic congestion.

Contrary to the belief of those who have had no experience with this type of car they are equally satisfactory in rainy seasons as in dry. A great number of ever-dry outside car seats have been invented and have proven practicable. This overcomes the objection of the clumsy appearance which is justifiably made regarding double-deck cars which have the upper deck enclosed and roofed in.

This type of car would prove a boon to the smoker. At the present time he is required to smoke in the vestibule or in some section of the car especially provided generally more or less filthy and in either case objectionable to the non-smoker. On the upper deck of a double-deck car he is an annoyance to nobody and smokes in comfort.

In California especially, such cars would prove popular and other places would also appreciate their special advantages. Taken together with the installation of a through car service for long-distance passengers and no street railway system, municipal or otherwise, could honestly say that a seat for all is not a realizable idea.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Hal Lauritzen, Holophane Works of General Electric Company, is at Los Angeles.

K. B. Ryan, formerly with the Vancouver Power Company, is at San Francisco.

W. G. Langdon-Davies, analyst, B. C. Electric Railway Company, was at Seattle last week.

Stanley Pearce, city electrician of Sacramento, has been appointed Jovian Statesman for that city.

W. H. Downing, erecting engineer, Arizona Copper Company, Clifton, Arizona, is at San Francisco.

R. L. Stafford, sales engineer Allis-Chalmers Company, Seattle, has returned from a business trip to Spokane.

Geo. M. Plover, manager Mark McConell Company, Santa Rosa, was a visitor at San Francisco during the past week.

Charles H. Lee, civil and hydraulic engineer, announces the removal of his offices to 1103 Central Building, Los Angeles.

G. R. G. Conway, chief electrical engineer B. C. Electric Railway Company, Vancouver, B. C., has returned from his New York trip.

Thos. Finigan, vice-president of Pierson-Reeding & Co., has returned to San Francisco from a two months' trip throughout the East.

H. C. Price, formerly chief clerk Oakland Branch Great Western Power Company, is now assistant superintendent of the Sacramento office.

E. L. Greer, formerly with the Tacoma Electric Railway Company, has entered the employ of the Pacific States Electric Company at Seattle.

Chas. C. Hillis, treasurer and general manager Electric Appliance Company, San Francisco, has returned from a trip made throughout the East.

Col. H. V. Carter, president Pacific States Electric Company, San Francisco, returned the first part of the week from a business trip to Los Angeles and the south.

S. B. Anderson, district manager of the Pacific States Electric Company, San Francisco, returned home after a month's business trip throughout the Pacific Coast territory.

S. L. Shuffleton, engineer in charge of construction for the Stone & Webster Construction Company, at the Big Creek Plant, Pacific Light & Power Company, is at San Francisco.

H. F. Lucia, at one time first assistant engineer with the Stromberg-Carlson Telephone Manufacturing Company and now with the General Railway Signal Company, is at San Francisco.

R. A. Thompson, engineer Interstate Commerce Commission, has been in Los Angeles in connection with the work to be undertaken by the commission in the valuation or railroad properties.

T. W. Seimon, treasurer of the Westinghouse Electric & Manufacturing Company, Pittsburgh, spent the past week in San Francisco and contemplates visiting the various branches enroute home.

A. M. Hunt, consulting engineer and chairman of the papers committee for the International Engineering Congress at San Francisco in 1915, has left for an extended Eastern trip in connection with the congress work.

E. M. Cutting, manager of the Edison Storage Battery Supply Company, San Francisco, has returned after an absence of six weeks or more during which he made an extended visit to various Eastern manufacturing cities.

Preston S. Millar, chairman of the Committee on Publicity of the International Electrical Congress to be held at San Francisco in 1915, announces the appointment of **O. H. Caldwell**, **F. H. Gale**, **J. C. Quiston** and **A. H. Halloran** as the other members of the committee.

John D. Orr, local manager, Idaho-Oregon Light & Power Company, at Nampa, Caldwell, Emmett, Middleton, Murphy and Silver City, wtih headquarters at Emmett, Idaho, stopped over at Salt Lake City on his return from a vacation.

H. F. Stratton, general manager and chief engineer of the Electric Controller and Mfg. Company of Cleveland, is studying alternating current motor control in Pacific Coast industries. He has visited Utah, Idaho, Washington and Oregon and is now in San Francisco, whence he will proceed to Los Angeles.

Henry L. Doherty is now chairman of the board of directors of the Denver Gas & Electric Company. In the reorganization the following changes have also been made: **Frank Frueauff**, president, was formerly vice-president and general manager; **W. G. Barker**, formerly second vice-president and general superintendent, is made vice-president and general manager; **E. E. McWhinney** is appointed assistant secretary, and **W. P. Troth** assistant treasurer.

MEETING NOTICES.

San Francisco Section, A. I. E. E.

The regular November meeting will be held Friday, December 5th, in the hall of the Native Sons of the Golden West, 430 Mason street. The paper of the evening will be a General Description of the Drum Development of the Pacific Gas and Electric Company, with Particular Reference to the Economic Conditions Governing the Engineering Design, and will be presented by Rudolph W. Van Norden.

Jovian League at Los Angeles.

The Jovian Electrical League of Southern California held a meeting at Christophers, Los Angeles, last Wednesday. The chairman of the day, Mr. H. B. Linch, introduced Mr. H. B. Fisher, manager Lecture Bureau, Panama-Pacific International Exposition, who then gave an illustrated talk on "What the Exposition Means to the State." There was considerable interest evinced and the attendance was good. Entertainment was also provided by a soloist and caricature comedian.

Utah Light and Railway Section, N. E. L. A.

The Utah Light and Railway Company Section, National Electric Light Association, held their first banquet of the season at the Welcome Cafeteria, Tuesday, November 18th. During the dinner a musical program was furnished by the Split Phase Quartet, under the direction of William Turner, who introduced some amusing electrical stunts with their songs. Those contributing to the program were Harry Dunbar, Will Emery, H. G. Fisher, Wm. Scott, E. C. Cathcart, Eugene Wellman and T. W. Keyworth.

San Francisco Electrical Development and Jovian League.

The subject of Load Factor Building was presented in an interesting address by Mr. R. B. Mateer at the regular meeting last Tuesday held at Tait's Cafe. Mr. Mateer has made a close study of this subject and placed clearly before the meeting the results both of his observation and experience. The important bearing of co-operation between all manufacturers, jobbers, dealers and the central station was emphasized, also the importance of carefully building up the business by the central station inaugurating and continuing a methodical canvass and educational campaign, and the means to that end were also touched upon.

Oregon Electrical Contractors' Association.

The Oregon Electrical Contractors' Association, after a vast amount of labor, has completed a "Price List of Electrical Supplies" for Oregon. The book will be off the press about December 1, 1913. It is made in loose leaf form and can be bound with the universal data and sales book issued by the National Electrical Contractors' Association. It will contain approximately 50 pages printed on both sides.

There is also incorporated in this book besides all supplies and material used in electrical contracting business, the retail price of same, notes on the local and National Electrical Contractors' Association, and much useful data compiled in the form of tables for contractors' use.

A copy of this book will be mailed to each member of the California State Association and each member of the Oregon Association. In addition there will be mailed a copy to each electrical contractor, who is not a member of the association in the states of Washington and Oregon, and doubtless this mailing list will not be complete, therefore if any electric contractor in the states of Oregon or Washington does not receive a copy he may obtain same by making a request to Mr. F. C. Green, 291 E. Morrison street, Portland, Oregon.

The Society for Electrical Development.

Forty-one manufacturers have taken out membership in the Society for Electrical Development, aggregating over $80,000 annually as their subscription to this very important trade movement. The particular group of forty-one referred to are members of the Electrical Manufacturers' Club, at whose meeting recently in Hot Springs the Society was a live topic of discussion both in the meeting and the lobbies. The affiliation with the Society of the other members of the Club is being carefully considered, and their co-operation will undoubtedly raise the subscriptions from this particular group to over $100,000 annually.

The President of the Club, S. O. Richardson Jr., in introducing the subject, gave the movement his warm personal endorsement, backed by the statement that his interests, the Libbey Glass Company, joined some months ago. J. Robert Crouse, emphasized the basic principles involved with special reference to the manufacturers. Gerard Swope, vice-president of the Western Electric Company, followed, explaining the detail plan of organization and the balanced representation cf the grand divisions of the business. He expressed the opinion that the plan and personnel of the officers and directors gave every promise of efficient and economical expenditure in the work.

F. S. Terry, manager of the National Lamp Works, addressed the meeting with reference to results which the Society can accomplish. He explained that the result of the earlier efforts in this same work in 1906 and 1907 had greatly exceeded expectations, and indicated an efficiency in market development by these methods which cannot be attained in any other way.

During the meeting, President Richardson received over fifty telegrams from electrical supply jobbers in all parts of the country, stating they were members, expressing their conviction of its value and the hope that all the manufacturers would join in the movement.

There are, of course, many manufacturers not members of the Electrical Manufacturers' Club, so that the figures given in the beginning of this paper are less than the actual.

The Society's objects, plans and methods of membership need only to be really understood to make a successful appeal to those who have not yet joined as it has done to the 700 and more companies in membership. It is in effect a wonderful opportunity for the electrical business to blaze a new trail in creative market development that will be in keeping with the great achievements in electrical research, engineering and manufacture. A pamphlet covering concisely the principles, plans and method of membership will be gladly sent, on request to the Society for Electrical Development, Engineering Societies Building, New York.

Directors' Meeting, A. I. E. E.

The regular monthly meeting of the board of directors of the American Institute of Electrical Engineers was held in New York on Friday, November 14, 1913, at 3:30 p. m.

President Mailloux announced the acceptance of Dr. C. P. Steinmetz of the appointment of honorary president of the International Electrical Congress, and the acceptance of Dr. E. B. Rosa as honorary secretary, which appointments had been authorized by the board at its October meeting.

President Mailloux further reported that the reorganization of the executive committee of the committee on organization of the congress had been completed, as follows:

Charles P. Steinmetz, honorary president of congress; E. B. Rosa, honorary secretary of congress; H. G. Stott, chairman; John W. Lieb Jr., vice-chairman; C. O. Mailloux, chairman sub-committee on International Relations; A. E. Kennelly, chairman sub-committee on program; Henry A. Lardner, chairman sub-committee on Pacific Coast Relations; H. H. Barnes Jr., chairman sub-committee on Transportation; George F. Sever, chairman sub-committee on Entertainment; Preston S. Millar, secretary-treasurer and chairman sub-committee on Publicity; F. L. Hutchinson, secretary A. I. E. E. (ex-officio).

Upon the recommendation of the Meetings and Papers Committee, the board authorized the following meetings in addition to the New York monthly meetings and the midwinter and annual conventions:

Institute meeting in Washington, D. C., April 10, 1914, under the auspices of the Electrophysics Committee.

Institute meeting in Pittsburgh, Pa., April 23-24, 1914, under the auspices of the Pittsburgh Section and the Committee on the Use of Electricity in Mines.

Institute meeting in Pittsfield, Mass., under the auspices of the Pittsfield Section.

Pacific Coast meeting in Spokane, Washington, September, 1914.

Upon the recommendation of the board of examiners, the following action was taken upon pending applications for election and transfer:

Thirty-five applicants were elected Associates.

One hundred and sixty-five students were ordered enrolled.

Elected to the grade of Member: Frederic S. Burroughs, Joseph P. Catlin, Max Hebgen, Thomas J. MacKavanagh, Robert Shand, Thomas A. Sproule.

Transferred to the grade of Member: Evan J. Edwards, L. S. F. Grant, J. D. Hathaway, W. R. Putnam, Henry H. Sinclair, Herbert W. Smith.

Transferred to the grade of Fellow: George A. Campbell, J. Paulding Edwards, J. L. Harper, John P. Mallet, D. B. Rushmore, E. F. Scattergood.

President Mailloux referred to the death on November 6th by Sir William Henry Preece, who had been an honorary member of the Institute since 1884, and suitable resolutions, previously prepared by a special committee which President Mailloux had appointed, were presented and unanimously adopted.

The president was authorized to appoint three representatives of the Institute upon the recently organized U. S. National Committee of the International Commission, and $100 was appropriated as the institute's one-third share of the U. S. National Committee's contribution towards the expenses of the commission. The other bodies represented on the committee are the American Gas Institute and the Illuminating Engineering Society.

The following committee appointments were announced by the president and confirmed by the board:

Railway Committee: Frank J. Sprague, chairman; E. B. Katte, vice-chairman; A. H. Armstrong, F. W. Carter, Frederick Darlington, W. A. Del Mar, C. E. Eveleth, W. S. Gorsuch, Hugh Hazelton, E. R. Hill, W. S. Murray, A. S. Richey, Clarence Renshaw, Martin Schreiber, N. W. Storer, B. F. Wood.

Committee on Electric Illumination: Clayton H. Sharp, chairman; Louis Bell, Frank Conrad, J. W. Cowles, E. P. Hyde, A. E. Kennelly, C. F. Lacombe, I. Langmuir, V. R. Lansingh, Preston S. Millar, E. B. Rosa, W. D.'A. Ryan, G. H. Stickney

INDUSTRIAL

POWERFUL ELECTRIC LOCOMOTIVES.

The New York Central and Hudson River Railroad Company recently ordered six additional powerful passenger electric locomotives from the General Electric Company for terminal service out of New York City. Early in the year ten electric locomotives of the most powerful type ever built were ordered from this company for the same service. These weigh 100 tons each. While the new machines are of the same type and construction, they are somewhat heavier, weighing 110 tons, and due to recent advancement in locomotive design, have materially increased capacity for continuous service.

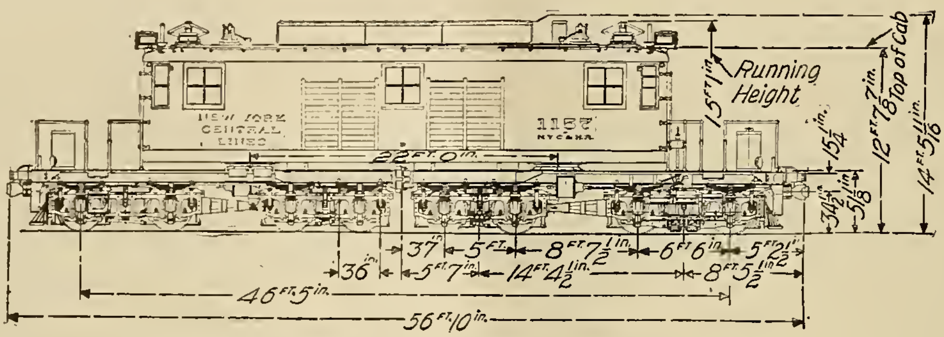
The growth in traffic and the corresponding increase in the demand for larger and heavier train units since the introduction of electric locomotives in the New York Central Terminal has been indeed notable. In 1906 thirty-five 600 volt, direct current passenger electric locomotives were built by the General Electric Company and introduced in the terminal. These machines are of the 115-ton, 4-8-4 type, and are each equipped with four GE-84 bipolar, gearless motors. Twelve more engines of the same type were placed in service in 1908. All these locomotives were designed with sufficient tractive effort to operate 535-ton gross weight trains at 60 miles per hour in the regular terminal service.

The ten 100-ton electric locomotives ordered the fore part of this year are designated type 4-4-4-4 and are each equipped with eight GE-89 bipolar, gearless motors, all the weight of the machine being carried on motor-driven axles. These engines are designed for pulling the heavy limited trains and will exert sufficient tractive effort to operate 800-ton trains in continual service between the New York Central terminal station and Harmon. They are capable of operating a 1000-ton train in emergency service or a train of the same gross weight on level tangent track continuously, at 60 miles per hour, or an 800-ton train at 65 miles per hour.

But the weight of trains which are being hauled out of the terminal is ever increasing steadily, and some of the more important trains now weigh over 1000 tons. It has therefore been deemed desirable to have engines for the maximum service with very great continuous capacity, ample overload and high momentary rating. The new locomotives are able to exert practically the same tractive effort continuously that the previous ten locomotives can for one hour.

The ten tons' increase in weight in these machines is accounted for mainly by the greater amount of material in the motors, which are of larger capacity. The speed and torque characteristics of the locomotive have been kept practically the same as those of the former ten machines, but the new locomotives are capable of hauling approximately 40 per cent. greater tonnage in continuous service.

The previous ten 100-ton locomotives have a capacity for developing 1460 horsepower continuously, 3000 horsepower for one hour and can develop as high as 5000 horsepower for short periods. This corresponds to a tractive effort of 9000 pounds at 60 miles per hour continuously, or 13,500 pounds at 54 miles per hour at the one hour rating. The six new electric engines will develop 2000 horsepower continuously, or 2600 horsepower for one hour. The equivalent tractive effort is 14,000 pounds at 54 miles per hour continuously, or 20,000 pounds at 49 miles per hour at the one hour rating. They are able to haul 1100-ton trains in continual service between the terminal and Harmon, are capable of operating 1200-ton trains in emergency service, and 1200-ton trains on level tangent track continuously at 60 miles per hour.



Dimensional Details New York Central Electric Locomotives.

In point of design and construction the new machines will be of identically the same type as the former ten engines, having an articulated frame with bogie guiding trucks at each end. The cab containing the engineer's compartment and that for the operating mechanism is swung between the two parts of the frame on center pins. Each section is equipped with two-axle trucks having a driving motor mounted on each axle. All the axles are therefore driving axles, and the eight motors, of the bipolar gearless type, are of the same general design as the motors on all the previous 57 locomotives, and are provided with ample forced air ventilation.

NEW REFLECTORS AND HOW TO USE THEM.

The Crouse-Hinds Company of Syracuse, N. Y., has issued a bulletin devoted to Reflectors for use in roundhouses, steel mills, etc. The bulletin also contains instructions as to how


Type RS.


Type RM.

and where reflectors should be mounted, to give the maximum amount of light where needed.

These reflectors are in two general styles. One, type RM, is not unlike, in appearance, an electric car headlight, and the other, type RS, is bell-shaped. Both have castiron cases and are gasketed, to make them gas, dust and weatherproof.

NEWS NOTES

ILLUMINATION.

CATHLAMET, WASH.—The city council has granted a 25-year franchise to Ingalls Bros. for furnishing Cathlamet with electric light. The terms of the franchise provide for a 10-year street lighting contract.

SAN BERNARDINO, CAL.—The city council has abandoned plans for a municipal electric railway, city hall and park site for the time being, but will proceed to secure a municipal electric light distribution system as soon as possible.

ARTESIA, CAL.—The Downey Light & Power Company has submitted a proposition to the Artesia Board of Trustees, relative to installing an electric lighting system in Artesia. The entire board has been appointed as a committee to investigate the matter.

SEATTLE, WASH.—Plans will be prepared under the direction of Superintendent of Lighting, Ross for construction of the first unit of the $450,000 auxiliary steam plant for the lighting department on Lake Union. This portion of the work will cost $100,000.

SEASIDE, ORE.—The Seaside Light & Power Company has been granted a 30-year franchise for operating an electric line in the city of Clatsop. The territory covered by this franchise is from the north boundary of Gearhart Park to the south boundary of Warrenton.

SAN ANDREAS, CAL.—The Pacific Gas & Electric Company has been awarded the contract to install and maintain poles, wires and all other accessories complete for the supplying of electric current for the Mokelumne Hill Lighting District of Calaveras county for a term of 5 years.

TILLAMOOK, ORE.—The ordinance relative to an electric light and power franchise which Messrs. Small and Urie are desirous of securing, was taken up for discussion. The site has been secured up the Trask river and the county has granted the company a 30-year franchise. A franchise from the city of Tillamook is now desired.

TRANSMISSION.

BREMERTON,, WASH.—At a meeting of the Bremerton city council W. D. Peters, a local attorney, appearing for promoters, offered to build a light and power plant to cost $288,000, which will be turned over to the city at the end of two years.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has filed an application for a franchise to construct and operate lines of poles with all necessary appurtenances for the conveyance of electric power, over roads, streets and other public places in King county.

SANDY, ORE.—An ordinance was read by the city council granting a five-year franchise to A. W. Botkin and Michael McCormick to supply this town with electric lights and power, the electricity to be developed at a plant under construction on Cedar Creek. The ordinance will come up for final passage at the January meeting of the council.

SAN FRANCISCO, CAL.—A resolution granting the Pacific Gas & Electric Company permission to erect certain poles for power line purposes was amended so as to secure to the city the right to use the poles free of charge and upon payment of proper proportion of the cost, or a rental, the right of any other electric power company to the use of the poles.

WOODLAND, CAL.—In order to determine the status of the case, the state water commission visited the Yolo Water & Power Company's plant in Lake and Yolo counties. The commission recently heard protests from ranchers in the two counties against the installation of a dam in Clear Lake by the power company. Attorney A. C. Huston of the power company, conducted the commission over the property.

AURORA, ORE.—The Aurora Electric Company has closed a deal by which it transfers its system to the Molalla Electric Company, an organization recently incorporated and which has also taken over the Molalla Power Company and the interests of the Canby Canal Company in the power plant on the Molalla River. It is reported that the company will issue bonds in a large amount to cover the cost of improvements.

OAKLAND, CAL.—An ordinance has been passed by the city council declaring in favor of the calling of an election for the purpose of securing a vote on the public utilities question. A public hearing will be held when both proponents and protestants of the plan to place in the hands of the railroad commission the control of all public utilities will be heard. City Attorney Woolner is arranging a specific ordinance setting the date for the calling of an election.

LOS ANGELES, CAL.—Rejecting the proposal of the power companies to lease their systems to the city with a view to ultimate purchase without additional bonded debt, the public service commission has framed a counter proposal, standing for immediate purchase, with submission to the railroad commission of the price to be agreed upon. The city council is in favor of calling a bond election immediately to secure funds to take over the distribution systems at once.

TRANSPORATION.

SEATTLE, WASH.—Bids will be received until November 28th for furnishing labor and material for the construction of one substation for the municipal street railway, Division A, to be built in Eden's addition.

BURNABY, B. C.—The board of works has decided to request New Westminster and Coquillam to appoint committees to co-operate with Burnaby in urging the B. C. Electric Company to proceed with the projected Sapperton and Coquitlam line.

OAKLAND, CAL.—Suit to recover $92,000 alleged to have been advanced to the United Properties Company was instituted by W. S. Tevis and R. G. Hanford who sought also to attach the Oakland Traction, a subsidiary company, for the amount.

TACOMA, WASH.—The council has voted to call an election at which $100,000 worth of bonds for a municipally owned and operated line across the Lincoln bridge to the tide flats will be placed before the people. The election will be some time in December.

STOCKTON, CAL.—Coincident with action of the new board of directors of the Stockton Terminal & Eastern Railway Company the word that the railroad will be placed in new hands and that active and aggressive work toward the early completion of the line to Jenny Lind, east of Stockton, and the establishment of a terminal on the Stockton waterfront will be started.

PORTLAND, ORE.—The city commissioners have granted a 25-year franchise to the Portland & Oregon City Railway Company, a new corporation headed by Stephen Carver, for an interurban electric franchise from the city limits on East Seventeenth street to the West Side business district by way of Hawthorn bridge and Fourth street. President Carver announced that work will be rushed to completion.

RED LODGE, MONT.—Consideration has been given by a committee of the Red Lodge Commercial Club to the construction of an electric line over the hill to connect Bear-

creek and Washoe by rail with Red Lodge. Articles of incorporation were filed, and a contract closed with A. J. Showalter, an Idaho promoter, to float the proposition by raising $100,000 in stock subscriptions on a commission basis. The capital stock is placed at $225,000, divided into shares of $100 each. The company will place $100,000 worth of stock on the market. Engineer Gibson will proceed with the survey.

SAN FRANCISCO, CAL.—A union electric railway depot at Eleventh and Mission streets, where local and suburban lines will meet at a central transfer point, is a plan now being worked out by municipal and railway officials. The lines involved, in operation and in prospect, according to the plans, are the San Mateo electric system, the Ocean Shore, the old Southern Pacific loop, which is to be electrified for suburban service, the Van Ness and Potrero avenue Municipal line and the Twin Peaks tunnel line, which will give service to the Parkside and other districts, along the ocean shore. The plan suggested itself to the city attorney through the request of the Ocean Shore line to cross Mission street and make use of its property, now used as a football field, for a depot.

SAN FRANCISCO, CAL.—City Engineer O'Shaughnessy reported to the board of public works last Monday that by December 1 he would have specifications ready for bids for furnishing cars, rails and other equipment for the extensions of the municipal railway system. He knows of no reason, he says, why the contracts should not be let about January 1. His estimate of the cost is $1,280,000. He estimates that $150,000 will be needed for the new carbarn and $350,000 for the purchase of equipment belonging to the Presidio and Ferries Railroad which will be of use to the city, the franchise of the company lapsing on December 11, making $1,780,000 in all that should be provided. The equipment items are as follows: Rails, rail joints and fastenings, $250,000; tie rods and nuts, $5000; tie plates, $20,000; rail spikes, $5000; redwood cross ties, $10,000; copper rail bonds, $10,000; track special work, $200,000; trolley poles, $40,000; street cars, $700,000; total $1,280,000.

OAKLAND, CAL.—To wage an active campaign for a central traction depot at Fourteenth and Franklin streets on the site of the present Southern Pacific local station, a committee, authorized by the Chamber of Commerce directors at their meeting last week, is announced by President W. E. Gibson. The committee consists of former Secretary of the Navy Victor Metcalf; former Governor Geo. C. Pardee, H. C. Capwell, Walter Leimert, Fred. Kahn, Jos. King, Jules Abrahamson and W. J. Laymance. The committee will hold meetings at once with Metcalf as chairman, and will, as soon as details are ready, turn over a proposition to Secretary A. A. Denison of the chamber to lay before the Southern Pacific Company. The project of a central depot was taken up a year ago by Metcalf, and later Secretary Denison in several conferences with railroad officials, secured a tentative consideration of the matter. A conference between the committee, Paul Shoup and E. E. Calvin will be called to further discuss the plan after Denison's date has been considered by the organization.

TELEPHONE AND TELEGRAPH.

CLOVERDALE, CAL.—Commissioner Thelen presided at the hearing of the California Telephone & Light Company, which operates in and around Cloverdale, for authority to issue $100,000 additional first mortgage 6 per cent bonds and $50,000 of stock. F. L. Wright, president and general manager, testified that since March 1st last the company has expended $47,398 in new construction, extensions and improvement of plant. Of this sum $15,225 was the remainder of the proceeds of a prior bond sale and the balance was taken from earnings. The company has filed with the commission a comprehensive engineering plan for the development of its field of enterprise in northern Sonoma county. Authority is asked to sell this allotment of bonds at 94 and the stock at 80, though no underwriting contract has as yet been signed.

SAN FRANCISCO, CAL.—The Nevada, California & Oregon Telephone & Telegraph Company has applied to the commission for authority to issue $27,500 of bonds. Of these bonds, $20,000 will be used to acquire the properties of the California & Oregon Telegraph Company, and $7500 will be used to pay off existing indebtedness. The former company conducts a telegraph business in Nevada, California and Oregon. The lines extend from Reno, Nev., to Lakeview, Ore., and pass through portions of Lassen and Modoc counties, Cal. The California & Oregon Telephone Company serves adjoining territory, including portions of Modoc, Lassen, Plumas and Sierra counties, in California.

WATERWORKS.

ANTIOCH, CAL.—The $25,000 bond issue for the improvement of the municipal water system was approved by the voters of this city.

LOS ANGELES, CAL.—Authority has been granted to the Indio Light, Water & Ice Company to sell its water supply plant at Indio, Riverside county, to H. E. Gard.

REEDLEY, CAL.—Sealed bids will be received up to December 16th, for the sale of the bonds of this city as follows: $40,000 for sewer system and $32,000 water bonds.

SAN DIMAS, CAL.—The San Dimas Water Company has applied to the commission for authority to sell $15,000 bonds for the acquisition of property and the development of new wells.

SAN DIEGO, CAL.—The city council has passed an ordidance calling a water bond election for December 30th. The amount to be voted is $705,000, $645,000 for improvements to the impounding system, and $60,000 for a filter plant.

EUREKA, CAL.—A resolution petitioning the state railroad commission to appraise the holdings of the Eureka Water Company, has been adopted by the city council. The desired appraisal is preliminary to submitting the question of purchasing the plant to the voters.

SAN FRANCISCO, CAL.—The Spring Valley Water Company has filed an application with the railroad commission for authority to issue $1,000,000 of 2-year collateral trust gold notes to bear interest at 5½ per cent. The company also asks for authority to pledge as collateral security for these notes its 4 per cent bonds in the sum of $1,334,000. The application states that the company expects to realize from the sale of its notes $980,000 and proposes to use the proceeds to pay off existing floating indebtedness. This floating indebtedness is represented by notes of the total of $975,000, held by San Francisco banks. The application also states that $5000 of this sum will be used in payment for work upon the Calaveras dam in Alameda county.

SACRAMENTO, CAL.—A. L. Shinn, representing the Mt. Shasta Aqueduct Company has presented a tentative proposal to furnish the city with McCloud River water. Shinn's proposition, which he says will assume definite form very soon in a proposal to the city commission, is summed up as follows: "The city of Sacramento by entering into a binding contract with us to take a minimum of 30,000,000 gallons daily can be provided with water at a cost of about half of what San Francisco is now paying. The water is not stored water. It has a 3 per cent hardness as compared with a 58 per cent hardness for the Sacramento River water. The water will be delivered under pressure to the distributing mains of Sacramento in a re-inforced concrete aqueduct channel. The proposition is to capitalize the project and give Sacramento practically a lease and option, the supply and the aqueduct, to be turned over to the city free at the expiration of a period in which the capitalization plus interest shall be paid in rentals."

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI SAN FRANCISCO, DECEMBER 6, 1913 NUMBER 23

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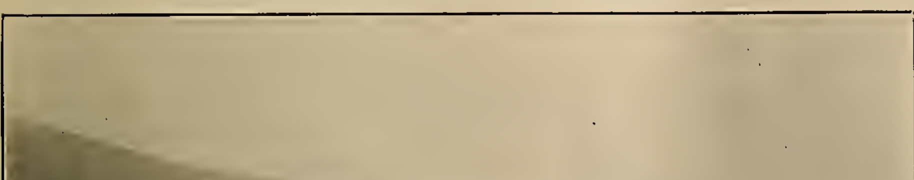
NORTHWESTERN ELECTRIC COMPANY'S SYSTEM.

BY B. C. CONDIT.

(This paper was presented before a Joint Meeting of the local sections of the A. I. E. E. and N. E. L. A. at Portland, Oregon. The author, who is the chief engineer of the Northwestern Electric Company, describes the company's system in that city.—The Editors).




White Salmon Power House.

When the Northwestern Electric Company first decided to enter Portland we gave quite careful consideration to the system of distribution to be used, and finally decided to follow as nearly as possible that of the Portland, Railway, Light & Power Company, a uniform system being very desirable.

We have, therefore, alternating current in all of our overhead distribution, using 11,000 volts, 3-phase delta for tie lines and outlying districts, this being again transformed to 2400 volts, both 3-phase and single-phase, for general distribution. In the underground district we are using 3-wire, 120-240 volts, direct current exclusively.

As we then had but one source of supply, the White Salmon River, 70 miles distant, it was necessary for us to consider an auxiliary source, and we first proposed a combined steam plant and main step-down substation on the East Side of the Willamette River, on Albina avenue, this being as near the center of distribution as our high tension line could be brought.

With this arrangement, however, the West Side and most important part of the city, would have been entirely dependent upon the tie lines connecting the stations, a portion of which would be submarine cables crossing the Willamette River, and we therefore felt that either a storage battery on the West Side would be necessary or that the steam plant should be located in the substation on the West Side.

The question of a central steam heating system arose, and as the combination of the West Side substation with the auxiliary steam plant and the central steam heating system offered many advantages, this was adopted.

We investigated as carefully as possible the steam heating system to be used, and decided upon low pressure, as installed by the American District Steam Company, as we wished to use exhaust steam, and the

American District system we felt was most desirable under these conditions.

Our present installation, therefore, consists of:

A main substation called the "Albina Station," at Albina and Loring streets, on the East Side, where power is received from our hydroelectric plant at 3-phase, 60 cycle, 60,000 volts, and transformed to both 11,000 and 2400 volts for distribution.

The "Pittock Station," located in the basement of the Pittock Building, on the West Side, where is combined the a.c. transformation from 11,000 to 2400 volts, and its distribution, the d.c. generating and distribution, the auxiliary steam plant, and the distribution of the exhaust steam for heating.

The Albina station is a three-story concrete structure. On the first floor is located the controlling switchboard, remote control 2400 volt circuit breakers, storage battery for operating the circuit breakers, four 2000 k.v.a. transformers, 60,000/11,000 volt, and three 500 k.v.a. transformers, 11,000/2400 volts.

White Salmon River Development—Dam Looking N. E.

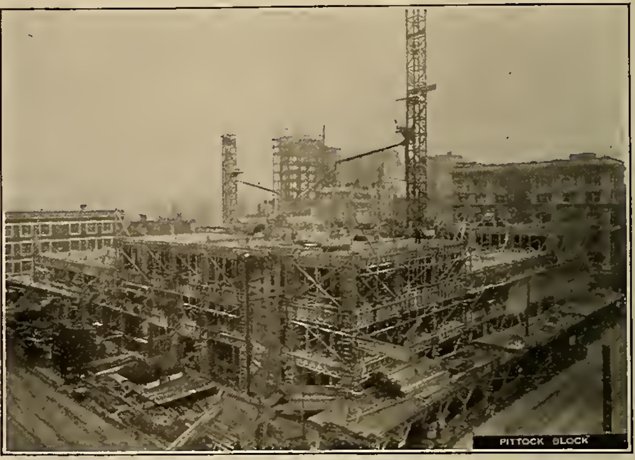
On the second floor is located the remote control 11,000 volt circuit breakers. On the top floor the 60,000 volt switches and aluminum cell lightning arresters.

Each transformer is located in a concrete fireproof cell. All switches in the station are electrically operated, remote control, and are handled from one switchboard.

The tie line between the Albina and Pittock Stations includes a submarine 13,000 volt, 3 conductor, No. 4/0 cable, which is installed with a messenger cable, this being a 1 in. steel cable, securely anchored, to which the main cable is secured. This method is patented by A. J. Pahl of San Francisco, and this is the first use of it in the Northwest.

At the time we were planning our system the Pittock Block, Inc., decided to build an office building covering the entire Pittock Block, 200 ft. square, and in this building we arranged to install our West Side station.

The Pittock Building is a reinforced concrete structure designed for eight stories over the entire block, although only one-half of the building is now being constructed to the full height. In the basement of this building, and entirely below the street level, we are installing an auxiliary steam plant, our a.c. transformers and distribution board for the West Side, and our d.c. generating station and distribution board for the underground district.



The Pittock Station in Portland.

The a.c. distribution system is the same as on the East Side, the power being brought from the Albina Station at 11,000 volts to the switchboard, a portion of it distributed at this voltage to the outlying districts, and a portion transformed to 2400 volts through three 15 k.v.a. transformers, for all distribution within reach of the station.

The d.c. apparatus consists of 1500 kw. motor generator sets, using three-phase 11,000 volt synchronous motors and 250 volt two-wire d.c. generators with balancer sets.

The auxiliary steam plant has 3000 normal h.p. of Stirling boilers, capable of 100 per cent overload, and two 3500 kw. Curtis turbines, generating three-phase current at 2400 volts, which feed directly into the 2400 volt switchboard.

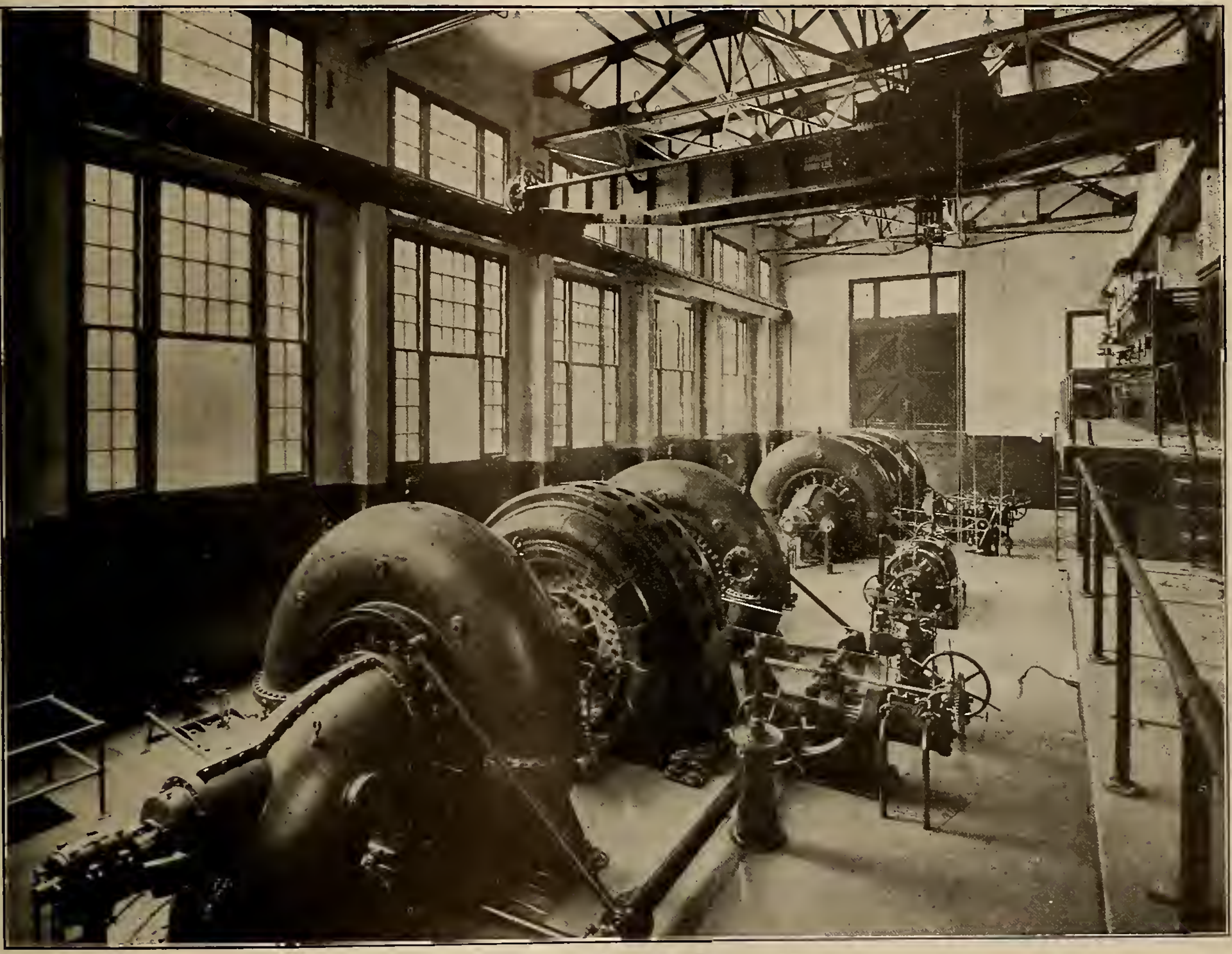
The switchboard is standard practice, all a.c., switches being electrically operated.

As condensing water is expensive and difficult to obtain at the Pittock Station, and as the turbines would be run non-condensing for furnishing steam heat under normal conditions, it was found to be most desirable to install them non-condensing, leaving out the last stages, and this was done, although the turbines are of the steam extraction type, and can at any time have the additional stages added to them and be made standard condensing machines.

The installing of this plant below the street level and in an office building entailed problems somewhat out of the ordinary, these problems being those of ventilation, heat, noise and vibration. Forced ventilation, of course, was necessary and this is provided for by an air shaft from the roof to the turbine room, where two large steam driven fans are installed to force the air into passages over the ceiling of the engine and boiler rooms, and through proper openings in the ceiling for distributing it to all parts as desired. The smokestack goes to the roof through a square

concrete compartment, and the heated air from the engine room, which is not needed for combustion, passes out through this compartment and around the stack. The turbines have a separate air shaft, and draw their own air from above the roof and discharge it into the stack compartment. The synchronous motors are entirely enclosed, and likewise have a separate air shaft from the roof, and draw a portion of their own air direct into the stack compartment. On account of their slow speed they cannot handle enough air when fully loaded, and a small booster fan is necessary for each machine, which by-passes the air duct.

The motor generators being of very slow speed no trouble was anticipated from them, but under favorable conditions the turbines at 1800 r.p.m. might cause some vibration, although even this was considered by those consulted as being exceedingly unlikely. In order to take all possible precautions, however, we decided to install the turbines and the motor generators on a massive concrete block which would be of sufficient size and weight to practically kill any slight vibrations, and to keep this block entirely separated from the building, at least until the matter was thoroughly tested.



Interior White Salmon Power House.

Forcing the fresh air used over the ceiling takes care of the heat, which might otherwise be annoying to the occupants above, but a double ceiling above this air space provides still further insulation.

Noise has been eliminated as far as possible by the entire enclosing of all apparatus except the d.c. generators, and the same insulation that cares for the heat also deadens the remaining noise.

Vibration was the point most to be considered, especially as the first design included a high grade theatre in the building, and it was possible for vibrations to cause a slight hum which would be undesirable in a theatre although not noticeable in any other case. The theatre was later abandoned, but the design of the plant was carried out as originally planned.

The bottom part of this foundation block is separated 18 in. from all building footings and walls, and the space is filled with crushed rock, this being the best material to break up any vibration. The building footings adjacent are on the same level as the machinery foundations, both resting on cemented gravel. The top of the foundation has a 3 in. clear opening around it.

The foundation is about 25 ft. wide, 130 ft. long by 12 ft. deep. In addition, the axis of the large steam turbines is at right angles to that of the motor generators and exciter, this making the vibrations at right angles to each other, and tending to eliminate both.

In studying the above subject, we gathered all information, and consulted all authorities, possible,

and it is the unanimous opinion that we shall not experience the slightest annoyance from the plant.

The steam heating system is designed to supply 2 lb. pressure to the most remote points, and it is estimated that it will require about 6 to 8 lb. pressure as a maximum at the station.

Two 20 in. pipes lead from the station to the streets, and these reduce in size to as small as 6 in. mains and 2½ in. services.

The steam pipes are pure wrought iron covered with a layer of asbestos paper. These pipes are placed inside of a wooden insulating pipe, the wooden pipe being of the continuous stave type, wound with galvanized iron wire, heavily coated with an asphaltum compound, and lined with a layer of asbestos paper and tin, and is large enough to allow about 1 in. clear space all around the steam pipe. When installed the top of this wooden pipe is in addition covered with a layer of heavy asphaltum roofing paper.

The trench is drained with two lines of tiling and 3 in. of gravel covers the bottom on which the pipe is laid.

Expansion and contraction in the iron pipe is cared for by variators placed every 100 ft. These variators consisting of corrugated copper discs properly mounted in flanges and fittings, and are guaranteed to give perfect service. The method of installing is to entirely enclose them in a brick box laid in concrete and buried, making no provision whatever for either reaching them for repairs or inspection, except through the digging up of the street and tearing out of the brick enclosing work.

Our electric underground distribution is of standard clay ducts laid in concrete, with concrete manholes. Wherever steam pipes and electrical ducts go in the same street they are laid together when possible in order to save expense, care being taken to keep the electric duct as far as possible to one side of the steam pipe and not directly over it, on account of the slight effect of the heat.

The laying of the 20 in. steam pipe with its enclosing wood pipe and variators and a line of some 42 electric ducts means some excessively heavy work, it requiring some trenches as much as 10 ft. wide and 14 ft. deep in order to get past and under other obstructions.

Railway safeguards in England have received considerable attention since the recent terrible disaster at Aisgill on the Midland Railway, which resulted in the loss of many lives, caused by the engineer running past a signal which was set against him. This has inspired the English press to urge the adoption of some mechanical means of safeguard when the human element fails, for it is recognized that accidents occur no matter what care is exercised by individuals. A "detonator placer" has now been installed on some sections of the Midland Railway, where it seemed most needed and it is said that the Aisgill disaster could not have occurred had one of these devises been installed at that point. The "detonator placer," costs about $14.60. It is thought that British legislation may compel all railroads to adopt some such signalling device.

ELECTRIC ADVERTISING.

BY J. HARRY PIEPER.

(The author sets forth the advantages of electrical advertising—show-window lighting and electric signs—and directs attention to the considerations most important to making this form of advertising effective. This paper was presented by Mr. Pieper before the Los Angeles Advertising Club, 1913.—The Editors.)

An admirable ever-ready and forceful medium whereby the merchant can advertise direct to all his prospective customers, is the electric-lighted show-window. It talks straight to the wants of the people. It does more than the printed ad. It holds the article out to you—but out of your reach. That is what starts the desire you never knew you had.

Therefore it is the profit-pulling power of this very show-window that gives value to the prominent corner. The merchant prospers to the degree in which he makes this silent salesman work, and his success is proportional to his attracting the attention and interest of every passer-by, and in impressing the value of the offerings on every possible prospect who comes within range of his window.

The big retail corporations that operate chains of cigar, notion, drug and liquor stores employ experts who do nothing but appraise the value of store and window locations. These experts are sent to look at a certain space; they count the passers-by, note what class of people they are, estimate their buying power. This investigation does not stop at dusk, but continues till midnight.

The proprietors want to know the after-dark value of the display windows.

The system that these big corporations follow should be copied by every retail merchant. Window lighting should not be left to chance—it should be appraised and its value known.

A window display is an advertisement—but instead of telling about the merchant's wares, it shows the actual goods. And every merchant knows the difference; if people did not want to see the goods, if they would be content with a picture and a price, all retail stores would soon give way before the mail-order idea.

And because a window is an ad. it has a set value. One pays one dollar an inch for space in a big daily paper or ten cents an inch for space in a country weekly. The price is based upon value. Is there any more valuable circulation than the evening crowds? Is there any time when the window display stands out as clearly as in brilliant contrast with the night? No! I'll answer that myself, for it is common knowledge.

We all know how light attracts humans no less than moths. And in the evening our eyes are ready for diversion, our minds are open to impression. When the day's work is done, the merchant's "circulation" is in its most receptive state and the cost of reaching these biggest opportunities is simply the cost of window illumination. Without that light the cleverest, most appealing display of goods is wasted after sundown.

The direct benefits of almost any sort of advertising are always more or less intangible. The average man does not stop to think why he buys. He does not realize what influence has attracted his at-

tention and induced the desire. It is a very small percentage who write in and say, "I saw your ad. in The Morning Screamer," and even less often do customers walk in and announce that they crossed the street last night to look at the window display and must have that pair of shoes.

Nevertheless, the ads in the Morning Screamer are selling goods every day, else there would be no ads; and the window displays are making sales every night, as witness the store fronts in any city. The money is not being spent on belief alone.

People like to see the goods themselves, and the desire to possess is one of the strongest of human traits. When we see in a store window a hat or a pair of shoes that look good to us, we think of it a dozen times before bedtime. Next morning we pass that way again and another look does the trick.

It rests largely with the merchant whether his window lighting shall be economical or expensive; whether it shall represent efficient advertising at a low cost of an indifferent display with a big bill for current. It is just as foolish to overlook the saving which may be effected by the proper treatment of the illumination as to disregard the value of displaying the goods after eight o'clock.

If the cost seems high, see if the trouble lies in the lighting equipment or in the window itself. Is all the light being utilized, or does the character of the window make it expensive to light?

Naturally the brightest window on Broadway will require a greater intensity of illumination per square foot of floor surface than the brightest window in a city of ten thousand, where the prevailing standard of illumination is not so exacting. But most depends on the window itself, for the color and finish of the walls, floor and ceiling and the nature of the goods displayed determine the quantity of light required. Dark colors absorb a very large percentage of all the light that falls upon them while light colors reflect light and therefore can be brilliantly illuminated in a window that would look dingy were the walls finished dark and dark goods displayed.

Many merchants believe that an aggressive electric sign is unnecessary in their particular case, because they are well known in the community and hold their trade through good service and the quality of their offering, but what of the newcomers' trade? Who gets that? The census returns show steady and universal growth in population—more men and women in almost every city in the land. In the aggregate they number into the millions. Who gets their business? They are newcomers in the town, without prejudice or preference, susceptible to the most favorable impression.

Then there is the floating population—transients—not traveling salesmen alone, but business men on various errands; men, women and children on vacations; and everyone buys as he goes. Then there are the home people who go out seeking some article in a hurry and ready to buy at the handiest place. The suggestion from a bright sign turns the trick. It has happened to everyone of us a hundred times.

When you walk down the street, it's the window where there is action that grabs your attention as you go by. That's why the sign that moves is a sure investment. Just as the steady burning electric sign works longer and faster than the ordinary painted one, the sign that flashes goes one step further. It is an advance agent, it reaches out and beckons. It catches the eye, not once but again and again. The first glance is fleeting, and you instinctively wait and watch for a good look to see how it works. The instinct of curiosity is in us all.

A great many merchants do not consider the use of a flasher because it increases the first cost of the sign. They overlook the fact that the most important point of cost is the monthly current bill and the most important point of all, the eye-catching power of the display.

The man who buys a sign should decide how much he can afford to pay each month for current, and then buy the biggest flashing effect he can operate within the figures. The value of an electric sign is in its power to compel attention.

There is one thing about electric signs and their operation that all are interested in, and that is the electric flasher, the mechanism that operates all flashing or moving signs. This machine operates so that the individual lamp or group of lamps in a sign are turned on and off by means of brushes coming in contact with metal strips mounted on a cylinder which is made to revolve by a small electric motor. All of the metal strips are connected to one side of the circuit and while the brush is in contact with the strip the circuit is closed to the lamp. Thus it requires as many brushes and strips on the cylinder as there are lamps or groups of lamps that are to be lighted at different intervals in order to give the desired effect.

Electric advertising is safe and sure, because in most cases the electric sign serves a double purpose, that of selling goods and of establishing a location.

To do effective electric advertising need not cost much, but the investment should be in proportion to the "circulation." A sign that is within sight of large numbers of people should be impressive; one that catches the eye of comparatively few may be small. In any case, the idea that the sign is an advertisement should be kept always in mind.

A most effective use of electric advertising has been made by real estate men. In one case, a row of new stores was advertised electrically. The stores fronted a well-traveled car line and the electric ad. caught the eye of every night passenger. It was cheap advertising because hundreds of possible renters saw not only the ad. but they saw the actual goods which the real estate man offered.

The merchant who puts on his store an electric sign that is also an advertisement is getting two profits from one investment. When you see a blaze of light and read the big sign that stands out against the night, the firm name has taken on a positive identity, and the picture lives in your brain to be recalled by the slightest suggestion.

The electric sign is a civic aid and the city with many electric signs is known as a "live town." Every merchant realizes what this means. To some folks the title "live town" may suggest a place where vice is ascendant, but the clear-sighted man of business knows better. It means a town or city where people are abroad in the streets after dark, studying the win-

dow displays, patronizing places of amusement and seeking relaxation from the day's work. In places where folks go to bed with the chickens, I use this word advisedly, the dry-goods merchant, the clothier, the milliner and the haberdasher do a dull business, for nobody cares to dress well unless they can "show off" their clothes. But in cities and towns where the lure of the lights bring people down to town after dark, trade of all sorts is brisk, people learn to spend more freely and the needs of the community are increased.

The city that is bright with light is safer, cleaner, more free from vice. Its people are happier, more progressive and more prosperous. So every electric sign and brightly lighted show window that is added helps not only the merchant but the street upon which it is erected, and the city also. It not only advertises the man whose name it bears, but helps increase property values and to win for the city the name, "A Live Town."

A great many merchants have conceived a prejudice against electric advertising, because they feel that it lacks dignity. But such is not the case. The church and the bank may certainly be looked to for example in dignified deportment. What is the significance of the steadily increasing number of electric signs to be found today on the most stately churches and the most conservative of banks? Modern stone and marble structures that represent the most carefully studied product of the architect are equipped with harmonious electric displays that broaden their influence without the slightest incongruity. The blazing cross on the summit of the church spire or the word "Come" high up on the belfry does not offend the most straight-laced churchman. The name of the bank shining out over the evening streets is simply an extension of that invitation to the public and that courtesy to customers seeking the institution that is freely offered within by officers and clerks alike.

The one electric display sign in Los Angeles owned and operated by a national advertiser, is the one at Fourth and Broadway on the roof of the Grant Building advertising Elgin watches.

This sign was erected by one of the largest outdoor advertising concerns in the country. When I tell you that they sent a corps of experts, headed by an electrical engineer, out here to erect this sign, and you realize the expense entailed by so doing, you can estimate just how valuable the Elgin Watch Company considers electric advertising. There are over 3000 lamps in this sign. The watch face is over six feet in diameter and the clock works stand five feet high, it being necessary to cut through the roof to allow the pendulum to swing.

If electric signs make for a life in the town that is business, let us all get together and work to that end.

Aerial transmission line patrol is a possibility, indicated by the feat of Robert G. Fowler, aviator, accompanied by Electrician Kitto, in paralleling the lines of the Great Western Power Company in an aeroplane. The distance of 68 miles between Brighton and Oroville, California, was made in two hours and eleven minutes.

CLEAN SALESMANSHIP.

BY W. F. WESTBROOK.

(This article should prove of interest to all salesmen. It contains pertinent pointers regarding clean salesmanship in selling electric service, and was presented as a short talk to central station salesmen. Mr. Westbrook is an assitant district agent of the Southern California Edison Company.—The Editors.)

In order to make a better showing we must make friends, and in order to make friends we must work. A good friend is the satisfied consumer, and it makes a good clean salesman to aid in giving that satisfaction—a man who is thoroughly acquainted with his line of work and who can give the people the straight facts and prove it with good service. Our goods will back any arguments, so you need never hesitate to talk a doubting customer into a sale, providing you do so in a clean gentlemanly way. Never misrepresent, for that will be our undoing quicker than anything else.

A satisfied consumer is an asset to any business. It means cheap advertising and a return call when they are in need of anything in your particular line. I know at times you have discussions with prospective customers, and I would listen to their arguments closely, in that way getting a wider view of public opinion, and it will also be a help in answering other people's questions—put you on your guard so to speak—for the wide-awake salesman has a satisfactory answer to all inquiries.

There are two classes of salesmen, one careful, the other careless. The careful salesman is the one that is always looking after the interest of his customer, especially the little details not familiar to the public in general. For instance, when a man is signing an application, if it is new business, call his attention to the fact that the company is not allowed to set the meter until the installation is first inspected and O.K.'d by the city inspector. Very often there is some slight defect in the wiring or fixtures, which holds up the O.K., and if these things are explained thoroughly by the salesman it prevents annoyance and wrong impression. The careless salesman doesn't think the little details worth while, thereby causing ill feeling on the part of the consumer and lots of extra work for the office. This reminds me of what Mr. R. H. Ballard said on Specialization: "This is the day of specialization, no question about it. You see it on all sides. We see the man who specializes coming to the front and getting himself recognized for certain higher positions and advancement. The management is always looking for a man who can do some one thing and do it extra well. We have a great deal of trouble from time to time in finding men who have progressed along their special line so far as to know all about it and be familiar with the subjects that come up daily in the various departments along their particular line. Specialization in the right way will bring you into prominence and make your future brighter than most anything I know."

I might add why not clean salesmanship. There is popular prejudice against all corporations and every man dealing with the public is considered the company.

What we have to do is to instil confidence into our customers and that confidence is gained by square dealing and clean salesmanship.

COST OF SEATTLE STREET LIGHTING.

The municipal lighting plant of the city of Seattle has been exploited throughout the country by officials of the city and the advocates of municipal ownership of public utilities as a shining example of the successful operation of a municipally owned utility. Officials of the city as well as those believing in municipal ownership of public utilities have repeatedly stated that the cost to the taxpayers of Seattle for street lighting had been materially reduced. After almost eight years of operation of the municipal street lighting system, it is interesting to observe how the taxpayer fares.

In order to fully appreciate what the following table discloses, it should be stated that the same series arc lamps with additions of the same kind thereto, purchased from the private company in 1905, are still in use. The series incandescent system is the same except that the more efficient tungsten lamp is used in place of the old carbon lamp. A study of the above table, based upon data taken from the 1911 report of the superintendent of the municipal plant (the last report issued), will reveal at a glance what has happened to the taxpayer.

A Comparison of Costs to the Taxpayer for Street Lighting in Seattle, Washington, Under Private Ownership in 1905 and Municipal Ownership in 1913.

Kind.	c.p.	Watts.	Year.	Line Drop Per Cent.	Watts per Hour.	3970 hrs. per Annum.	Kw.-hr. Rate.	Cost per Lamp.	Increase Municipal Ownership.
Incandescent Carbon	30	106	1905	13.5	123	488	3.07	$15.00	
			1913	13.5	123	488	4.5	21.96	$6.96
Incandescent Carbon	32	80	1905	20.	100	397	3.07	12.19	
			1913	20.	100	397	4.50	17.87	5.68
Incandescent Tungsten	40	50	1905	20.	60	238	3.07	7.31	
			1913	20.	60	238	4.50	10.71	3.40
Incandescent Tungsten*	40	50	1905	13.5	58	230	3.07	7.06	
			1913	13.5	58	230	4.50	10.35	3.29
Arc*		430	1905	13.5	500	1985	3.33	66.00	
			1913	13.5	500	1985	4.50	89.33	23.33

*Series.

It will be noted that the cost to the taxpayers of a series carbon incandescent street lamp in 1913 under muncipal ownership would be $6.96 per annum more than in 1905 when furnished by the private company. Tungsten lamps are, however, being used, and the cost to the taxpayers in 1913 is $3.29 per annum more than if furnished at the rate that current was sold to the city by the private company in 1905. It should be noted that the carbon 6.6 ampere incandescent lamps cost in 1905 more than the present series tungsten lamps used.

In the cluster posts, 32 candlepower, 80 watt lamps are used in many instances; the cost of these lamps to the taxpayers in 1913 is $5.68 per annum more than the taxpayers would have had to pay under the rate charged by the private company in 1905. In other words, the taxpayers were paying the private company in 1905 a rate of 3.07c per kilowatt hour for incandescent lamps used for street lighting as against a rate of 4.5c charged the taxpayers by the municipal plant in 1913. The cost of these lamps was greater in 1905 than the present cost of the same lamps.

In the case of the series arc lamps that are being used by the city in 1913, and which are the same lamps that were used by the private company in 1905 for street lighting, the taxpayer is paying $89.33 per annum for each arc lamp as against a charge of $66.00 per annum by the private company in 1905.

ELECTRIC COOKING—CONSUMPTION AND COST.

BY S. J. HALLS.

(A recent short item on "Electric Cooking at Victoria, B. C., aroused considerable interest on the part of some of our central station readers and further information was asked for. In response to an urgent request, Mr. Halls, manager light and power department, B. C. Electric Ry. Co., who is largely responsible for the popularity of electric cooking at Victoria, hurriedly compiled this article. Further data is promised.—The Editors.)

Interest having been expressed in the wonderful increase in electric cooking at Victoria, B. C., the following information regarding the rates charged and the cost of this service to the consumer has been cheerfully compiled.

We charge a rate of 5 cents per kw.-hr., this being an average of our power rates for the small power customer, subject to a minimum charge of seventy-five cents per connected kw.. This rate has met with universal favor, probably accounted for by the fact that monthly bills are much lower than one would expect.

The accounts of twenty customers selected at random, but representative of the rest, were analyzed. They show a total connected load of 74.5 kw. or an average of 3725 watts per customer, the maximum load being 4.5, and the minimum 2 kw.

From January to June of this year, both months inclusive, their average monthly consumption was 86 kw.-hr. per customer; the highest individual average being 184 kw.-hr. and the lowest 45 kw.-hr. per month; with an average monthly consumption of 23.2 kw.-hr. per connected kw. The lowest amount paid to us during that period, was a bill for $1.75, the minimum charge on a small connected load and the highest, $12.45, the load being 4.5 kw.

On account of the minimum charge made the average price over the period and for the customers considered was 5.44 cents per kw.-hr. The highest earnings per month per connected kw. is $3.00 on a load of 2 kw., and the lowest 65 cents on a connected load of 4.5 kw.; the average earnings per connected kw. being $1.26 per month. The smaller connected loads show the best average earnings.

There seems to be but little influence of the seasons upon the current consumption. The highest monthly total was in January, the next highest in June and the lowest in May, although February, being a short month was not less than the average.

The average kilowatt hour consumption per customer by months was as follows:

Month. 1913.	Ave. Consumption kw.-hr.
January	97.
February	80.
March	87.
April	82.
May	79.
June	90.

THE PITOT TUBE FOR MEASURING WATER.

BY BEN D. MOSES.

It has been found experimentally that the velocity of water in a pipe varies at different distances from the center. At the center it is higher than at the boundaries.

In the study of the comparative velocities let us consider all the particles of water in the plane EF Fig. 1, normal to the pipes axis and examine their behavior during flow. These particles would for per-

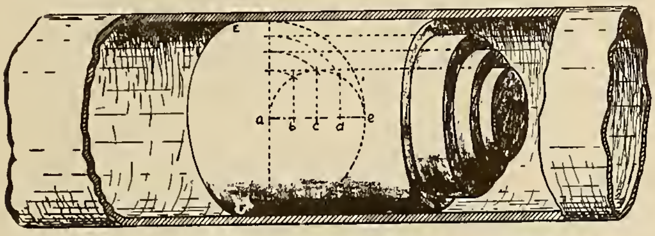


Fig. 1. Showing the Pipe Method of Considering the Water Flowing Through Circular Tubes, and Geometrical Method of Sub-division Into Equal Sectional Areas.

fect axial flow proceed to arrange themselves in a hemispherical shaped surface which as time goes on becomes sharper and sharper at the axis. (See Fig. I, abc).

Now assume that this flow is purely axial and that there is no cross flow, eddying nor whirling, and too, that the water stream behaves as a series of concentric annular cylinders flowing one within the other, their respective speeds increasing as they are located nearer the axis of pipe, each cylinder moves as a rigid pipe. The greater the number of divisions into these pipes, the nearer is the approximation to the true state.

Let the distance through which any ring, whose cross-sectional area A, move in one second, be y. The volume $A \times y = Q$ is then the quantity in cu. ft. per sec. represented by the particular "pipe" chosen.

The volume for each pipe being its cross-sectional area multiplied by its velocity, the total volume is the sum of the volumes of all these pipes, or

$$Q \text{ total} = (A_1y_1 + A_2y_2 + A_3y_3 + \ldots\ldots\ldots\ldots A_ny_n)$$

if, however, the areas are all the same or

$$A_1 = A_2 = A_3 = A_4 = \ldots\ldots\ldots A_n$$

the expression reduces to

$$Q = A\,(y_1 + y_2 + y_3 + \ldots\ldots\ldots y_n)$$

This condition can be very easily satisfied geometrically as follows (See Fig. 3): A semi-circle is described on abcde, the radius of the pipe, which is divided into as many parts as there are areas required, r_1, r_2, r_3, etc., will then be the respective radii since $r_1^2 = ab \times ae$; $r_2^2 = ac \times ae$, etc.; r_1, r_2, etc., being a mean proportional between the opposite side and its subnormal. If $ab = bc = cd$, etc.; the areas A_1, A_2, A_3, etc., will be equal.

The rings A_1, A_2, A_3, etc., represent then the "pipes" of water running each with its uniform velocity, which is very nearly the actual velocity of the center of each ring, shown on diagram as y.

Our subdivision is now complete and all that remains is to obtain the y corresponding to each ring.

The Pitot tube, or any of its modifications actually enables us to enter the tube or pipe and really investigate the velocities at different positions.

Let a bent tube AB, Fig. 2, be inserted into a pipe through a suitable cock, with the nozzle B pointed up stream. For no flow the water will rise in the tube to some point, h such that $h_1 = p/w$, where h is expressed in feet and p is the pressure

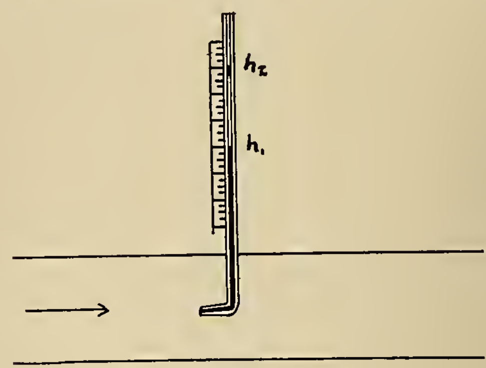


Fig. 2.

in pounds per sq. ft., while w is the density of water per cu. ft. Now let there be some flow in the pipe in the direction V. The nozzle has acting upon it, in addition to the static pressure, the additional pressure due to the velocity of the flowing water and the water will rise in the tube approximately $h_1 +$ the velocity head. This last is proportional to the expression $\frac{v^2}{2g}$ and might be taken as $K\frac{v^2}{2g}$ and the surface will now read h_2 and the difference $h_2 - h_1$ will be a measure of velocity or $= \frac{Kv^2}{2g}$. Finally if two tubes be placed on the same scale with one nozzle with, and one against the stream, the difference $h_2 - h_1$ will be greater than for the single nozzle, but will still be a measure of v or

$V = C\sqrt{2gh}$ where C is some coefficient and h is the difference between the two levels in the tubes.

From the V taken at various points in pipe, the velocity position curve can be plotted and, from the construction show in Fig. 3, the average square roots of the velocity head for each pipe obtained, and by substitution in the following equation, which is substantially the same as Equation No. 1.

$$Q = \frac{A}{h} \times C\,\sqrt{2g}\,(\sqrt{2g} + \sqrt{h_2} + \sqrt{h_3} + \sqrt{h_4} \ldots\ldots\ldots)$$

The quantity Q can be found, provided the constant for the instrument C is known. If, however, we are looking for this constant, as is the laboratory problem, the quantity is actually measured, and the only unknown, C, solved for.

$$C = \frac{nQ}{A\sqrt{2g}\,(\sqrt{h_1} + \sqrt{h_2} + \sqrt{h_3} \ldots\ldots\ldots)}$$

in which $Q =$ cu. ft. per second.

h_1, h_2, h_3, etc. = average values at $(h_2 - h_1)$ taken from the curve, Fig. 3.

C = constant of the instrument.

A = area of the pipe in sq. ft.

n = number of subdivisions.

When once this constant has been found the instrument can be taken into the field and depended upon to a wonderful degree as an efficient method of measuring water flowing in a closed pipe.

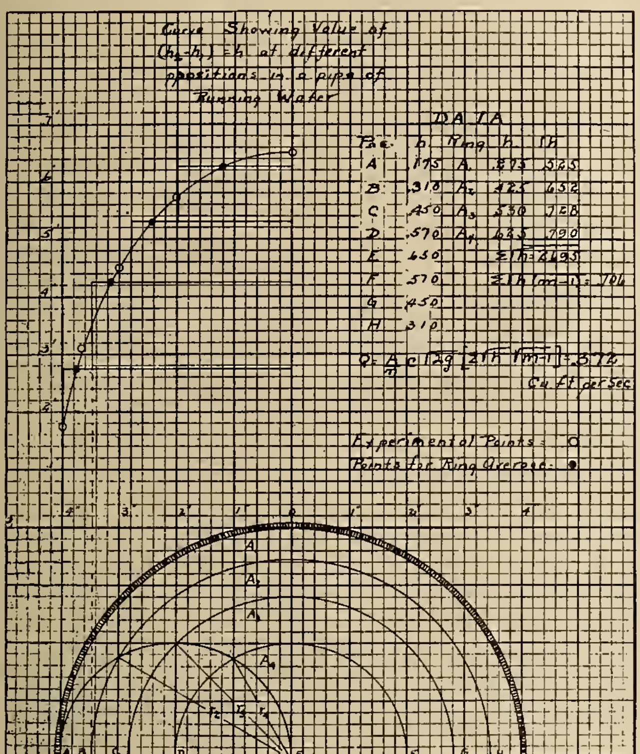


Fig. 3.

Fig. 3 shows the results as worked up from data taken on an 8 in. pipe and the equation for Q is seen to have the term $\sqrt{m-1}$ incorporated. The reason for this, is that carbon tetrachloride, which has a specific gravity of 1.5, was used in the manometer.

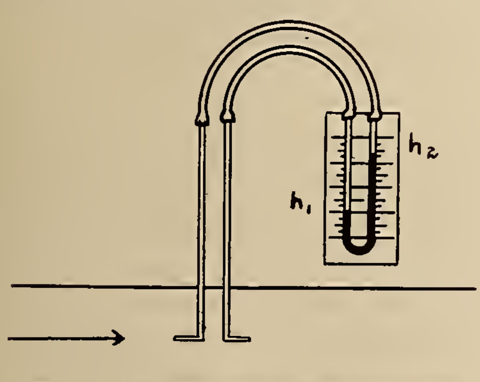


Fig. 4.

If d = weight per cu. ft. of carbon tetrachloride, and w = weight per cu. ft. of water, then, see Fig. 4, by balancing the columns, using AB as a plane of reference, the pressure at A must = that at B for equilibrium

or $(h_2 - h_1) = (h_2 - h_1)\ w + (p_1 - p_2)$

or expressing $p_1 - p_2$ in terms of ft. of water:

$(h_2 - h_1)\ d - (h_2 - h_1)\ w = hw$

$$\text{and } h = (h_2 - h_1)\ \frac{d}{w} - (h_2 - h_1)$$

but d/w = specific gravity of carbon tetrachloride = m

$$\therefore h = (h_2 - h_1)\ m - (h_2 - h_1)$$

$$\text{or } h = (h_2 - h_1)\ (m - 1)$$

by controlling m of the fluid, it is possible to obtain as sensitive a device as we may desire; for instance, mercury with m of 13.6 would register a difference in heights $(h_2 - h_1)$ of $\frac{1}{m-1} = .0735$ for a difference at nozzles of 1 ft. while carbon tetrachloride would show a difference

$$h_2 - h_1 = \frac{1}{1.5 - 1} = 2$$

or 2 ÷ .0735 = 27 times as much.

In conclusion it may be stated that a general study of the velocity curve shows the average for steady flow to vary between .5 and .75, that at the center.

DECISION RENDERED IN POWER SUIT.

A decision that is expected to have a far-reaching effect in determining land title cases in which companies or individuals have made improvements on Federal property without obtaining proper authority from the Secretary of the Interior, has just been rendered by the United States Circuit Court of Appeals in St. Paul. The decision reverses that of Judge John A. Marshall of the United States Court of this district in the case of the United States vs. the Utah Power & Light Company.

The court decides that the power company has no rights to the land it occupies in the Bear River national forest in Cache county, Utah.

Since the suit was brought by United States District Attorney Hiram E. Booth to perpetually enjoin the company from maintaining an alleged unlawful possession of these public lands, the decision would possibly permit the government to confiscate the entire property of the company on the forest reserve.

It is expected that the case will be taken to the Supreme Court of the United States, although officials of the company report that they have not decided on their future action as yet.

The basis of the suit, as recently reported in this journal, is the contention of the Federal Government that companies occupying national forest reserve must obtain permission therefor under the provisions of the act of congress passed in 1896. The company maintains that their occupation of the Federal land was done lawfully under the Forest Land Act of 1866. Judge Marshall held that the property of the power company was not affected by the Act of 1896 because it has been built before the act was passed. The decision of the court of appeals holds that the act of 1896 does affect the property, and that the act of 1866 grants permission only for operations in connection with mining and irrigation and does not apply to electric power plants.

REPORT ON LOS ANGELES DISTRIBUTION SYSTEM.

Letter of Transmittal.

Los Angeles, Cal., Nov. 22, 1913.

The Honorable City Council, Los Angeles, California.

Gentlemen:—In accordance with your instructions as set forth in the contract between the City of Los Angeles and the undersigned, under date of November 11, 1913, which were as follows:

To examine and report in writing to the city council of Los Angeles.

(a) The cost of installing a distribution system such as would be appropriate for taking care of all electrical service within the city, exclusive of railways;

(b) The annual cost of operation of such a distributing system; and,

(c) An estimate of the annual income which the city would derive from the operation of such a distributing system.

We herewith submit our estimates as follows:

(a) The cost of installing a distributing system such as would be appropriate for taking care of all electrical service within the city, exclusive of railways, as of this date, would be $5,697,635.00.

(b) The annual cost of operation of such a distributing system would be $1,283,716.00.

(c) The annual income which the city would derive under the conditions set forth herewith, from the operation of such a distributing system would be $2,029,000.00.

We beg to state that our estimate is based upon the installation of a distributing system that would cover the city of Los Angeles, making provision for reaching any customer within the present city limits, and adequate to distribute a peak load, measured at the customers meters, of approximately 36,000 horsepower, equivalent to 26,860 kilowatts, which was the peak load of all electrical service within the city, exclusive of railways, in October, 1913.

The estimate of the annual income which the city would derive from the operation of such electrical distributing system is based upon the assumption that approximately 80,000,000 kilowatt hours would be delivered to customers' meters and sold at an average rate of $.033 per kilowatt hour, which assumption means that the city, through this distributing system, would supply approximately all of the present electrical service required within the city of Los Angeles, exclusive of railways.

The average rate of $.033 per kilowatt hour of electrical energy delivered to customers' meters has been determined from the figures of gross receipts furnished to the board of public utilities by the three operating companies from their records for the year 1913, under a maximum base rate of six cents per kilowatt hour, and upon the assumption, however, that the maximum base rate to be charged by the city per kilowatt hour would be five cents and the average rate for electrical service to customers reduced in the same proportion.

C. L. Cory G. L. Hoxie C. W. Koiner
Consulting Engineers.

Cost of Installing Distribution System.

In estimating the cost of installing an electrical distribution system, as set forth in detail below, we have assumed that it will be appropriate to meet the requirements of providing all electrical service within the city, exclusive of railways, the peak load, aggregate number of customers and total consumption in kilowatt hours to be practically that required at the present time.

All electrical energy is to be delivered from the transmission lines to a receiving substation located near Main street on the east bank of the Los Angeles River. From this receiving substation it is proposed to construct 33,000 volt, 3-phase overhead lines to six other substations, within the main city of Los Angeles, located approximately as follows:

(1) East of Alameda street, near Sixth street;

(2) Near the intersection of Sixth street and Union avenue;

(3) Near the intersection of Santa Barbara avenue and Figueroa street;

(4) Near the intersection of Pico street and Western avenue;

(5) Near the intersection of Fountain avenue and Gower street;

(6) Near the intersection of Avenue 64 and Marmion Way.

The electrical service in the business section, within the underground district, will be furnished from the three nearest substations, located without the underground district, the 2200 volt, 3-phase feeders being carried overhead to the limits of the underground district and then carried underground to transformer vaults conveniently located. Service to San Pedro is provided by a 3-phase, 33,000 volt overhead line, terminating in a substation there located.

In the various substations the necessary step-down transformers and auxiliary apparatus are provided, so that alternating current may be delivered at 2200 volt, 3-phase to distribution transformers, from which power will be furnished at 110 and 220 volts alternating current.

Motor generator sets for 500 volt direct service are provided, where necessary, in the different substations.

In the proposed distribution system it has not been deemed desirable to provide an entirely new and extensive 110 and 220 volt direct current service.

The proposed electrical distribution system which will be of the most modern character with minimum distribution losses, to meet the requirements of the present time, so designed, however, as to make its extension and enlargement readily accomplished, and the estimate of the cost of such a distribution system should not be confused with the existing electrical distribution systems which have necessarily been built piecemeal, coincident with the exceedingly rapid growth of the city during the past twenty years, and the original cost, or cost of reproduction new, of the present distribution systems.

Annual Cost of Operation.

From data on file at the board of public utilities of Los Angeles, for the year 1912, which data includes the total kilowatt hours of electrical energy sold to

consumers within the city of Los Angeles and also the annual cost of distributing this power, including distribution expense and general expense, it has been determined that the probable annual cost of distributing all of the electrical power required at the present time, exclusive of railways, will be approximately $600,000 per annum.

In addition the fixed charges upon the total investment in the distribution system, which include interest on bonds, depreciation, obsolescence and sinking fund, have been placed by us at 12 per cent of the estimated cost of the system, or $683,715.00.

The total annual cost of operating such a distribution system, therefore, including maintenance and operation, general expense, and fixed charges, would be $1,283,716.00.

Estimated Annual Income.

The annual income from the sale of electrical energy in the city of Los Angeles will naturally depend upon the total amount of power which can be sold and the average rate per kilowatt hour paid by consumers. From the records placed at our disposal by the board of public utilities, on a maximum base rate of six cents per kilowatt hour, the average price paid by consumers for electrical energy in Los Angeles for the elapsed portion of the year 1913, exclusive of railways, was $.0396. On a base rate of five cents per kilowatt hour, and assuming that the average price paid by consumers would be in the ratio of five-sixths of what was actually paid by such consumers during that portion of the year 1913 which has passed, the average return per kilowatt hour would be $.033. If a total of 80,000,000 kilowatt hours were delivered and sold to customers' meters at this rate, the gross revenue would be $2,640,000.

In order to provide for losses between the receiving substation and customers meters, the committee has estimated that a delivery of approximately 94,000,000 kilowatt hours would be required at the receiving substation in Los Angeles, at the end of the tranmission lines. Crediting the generation and transmission system with 94,000,000 kilowatt hours per year at a unit price of $.0065 the cost of the electrical energy delivered to the receiving substation would be $611,000.

The annual income, therefore, which the city would derive as the result of the operation of a distribution system would be represented by the gross revenue from current sold to consumers, reduced by the cost of electrical energy delivered to the receiving substation. Assuming that 80,000,000 kilowatt hours were delivered and sold to customers, the resulting annual income from the distribution of electrical energy would be $2,029,000.

Estimate of Cost of Electric Distributing System for Los Angeles.

November, 1913.

Underground Systems—		
700,000 duct feet of duct at 30c	$210,000	
550 manholes at $100	55,000	
150 transformer vaults at $250	37,500	
Primary Cables—		
212,000 lb. T. B. W. P. wire at 20½c	43,460	
60,000 ft. 3 cond. lead at 56c	33,600	
28,000 ft. 3 cond. lead at 25.2c	7,056	
Secondary Cables—		
155,000 ft. No. 4/0 Duplex at 48.8c	75.640	
70,000 ft. No. 1 Duplex at 27.1c	18.970	
55,000 ft. No. 1/0 Single at 17.6c	9,680	
35,000 ft. No. 4	3,920	
Ornamental Lighting—		
Services and Connections—		
3,284 services with one extension each at $82.83	272,014	$847,840.00
Overhead—		
33,000 Volt Feeders to substations, 219,500 lb. No. 0 at 20.5c	44,998	
800 double pole tops) 600 single pole tops)	9,500	
Primary and Secondary Copper—		
2,470,000 lb. at 20.5c	506,350	
Poles—		
35,000 at $17.75	621,250	
105,000 cross arms at $1.17	122,850	
5,000 guys at $2.50	12,500	1,317,448.00
Transformers, Services, Etc.—		
Transformers—28,000 kw. at $9.60	268,800	
Grounding 3700 transformers, at $4.00	14,800	
Service Connections—57,684 at $7.00	403,788	
Meters—90,000 at $9.00	810,000	
Arc Lamps—3757 at $33.50	125,860	
1110 miles No. 6 wire at 21c per lb	137,529	
Incandescent street lighting	10,600	1,771,377.00
Transmission and Distribution to San Pedro—		
2200 poles at $16.00	35,200	
200 33,000 volt double circuit pole tops at $8.60	6,880	
4400 cross arms at $1.17	5,148	
220 guys at $2.50	550	
120 miles No. 0—202,560 lb., at 20.5c	41,525	
2200 volt primaries, 50,280 lb. at 20.5	10,307	
Secondaries—43,725 lb., at 20.5c	8,964	108,574.00
Substations—		
27,220 kw. at $15.00	408,300	408,300.00
Operating Expense—		
Buildings, real estate warehouse and testing department	55,000	
Machine shop, equipment and winding room	15,000	
Laboratory and testing equipment	5,000	
Office equipment	15,000	
Stock	60,000	
Stable, equipment, automobile, garage and real estate	100,000	
Pole yard and equipment	15,000	265,000.00
Total		$4,718,539.00
Engineering, superintendence, etc., 7½ per cent		353,890.00
Contingencies, 7½ per cent		353,890.00
		$5,426,319.00
Interest, 5 per cent for one year		271,316.00
Grand Total		$6,697,635.00

SUGGESTED CO-OPERATIVE PLAN.

BY R. H. BALLARD.

(Mr. Ballard, secretary and assistant general manager of the Southern California Edison Company, clearly analyzes the report recently submitted to the city of Los Angeles advocating the municipal construction of a municipal distributing system for aqueduct power. He brings forth the advantages of co-operation between the city and the corporation and shows the dangers of competition. His masterly presentation is worthy of careful study.—The Editors.)

Co-operation is the word of the hour. It is in the mouth of the laboring man, merchant, manufacturer and banker. In the past 20 years we have laid the foundation of our southwestern empire, and the completion of the Panama Canal gives us our opportunity to make this empire the home of an enormous population of thrifty people. To accomplish the destiny which we all believe is ours, we need money and we need credit. There are great ranches to be turned into intensive farms of the thrifty agricultural class; there are factories to be built to turn our raw materials into finished products; the city is urgently in need of water main extensions, storm drains, schools, parks, municipal buildings and tunnels, and our property owners are protesting vigorously against the continuance of the assessment plan to raise funds for such purposes. Any movement, public or private, which will destroy or lessen the earning power of the money already invested in securities of Southern California tends to shut the door of credit against us.

Truly the time has come when co-operation is a necessity, and a real achievement along this line will be a working basis upon which public service corporations and the people's representatives in city govern-

ment can work shoulder to shoulder in all things for the greatest possible development. Can the corporations be assured that they will not be made the football of politics? Can the people be assured that the rights and privileges granted by them will not be abused by the corporations? For the answer to this last question, we need but call to mind the state constitution and laws which confer upon the people's representatives in state and city governments complete regulation of public service corporations. Take the state railroad commission, for instance. Its powers take from public service corporations their financial and many of their executive functions, bringing them in reality to the position of public servants. You may know that no California public service corporation can issue or sell one dollar's worth of stock unless the right to issue such stock is authorized by the state railroad commission. The commission names the price at which the stock may be sold, and the purposes for which the funds may be expended. It makes a rigid inspection and valuation of properties, and says whether or not the proposed expenditures are necessary. It prescribes a system of accounting and prohibits the use of any books or records not specified in this system. It precludes the issuance of what is commonly known as "watered" stock. This has passed and will soon be so far reminiscent as to take its place with vigilantes committees, the picturesque cowboy and all that went with an earlier civilization.

Regulation of rates by the state railroad commission and other regulating bodies eliminates the possibility of excessive or undue profits, as the four fundamental principles of rate regulation are interest on a fair value of the property, depreciation, operating expenses, and volume of business, duplication of property means doubling interest and depreciation and in the long run higher rates to consumers. There is no escape from this. Duplication of the electric distributing systems in Los Angeles would mean an economic waste variously estimated at from $5,500,000 to $9,000,000 or more, which of necessity would increase annually. It would require the setting of approximately 45,000 unnecessary poles and tearing up and replacing more than 400,000 sq. ft. of street paving.

Negotiations are now proceeding between the city of Los Angeles and the electric companies looking to effecting a co-operative arrangement having all the advantages, both to the city and to consumers, of complete municipal ownership, and in addition placing at the city's disposal the services of trained men and experts. The city would deal directly with consumers, collecting all bills in the name of the city, making full use of the city's power distributed direct to consumers, paying the companies only for the use of their systems and for services rendered. The city would secure the entire Los Angeles market, could reduce rates to a 5 cent basis, and have a fixed and certain income from the use of its power of approximately $1,000,000 per year.

At the present time the distributing systems of the companies could not be sold to the city, were the city in position to buy and had its money in hand to pay for them. The properties are subject to various mortgages, securing bonds, which cover not only the distributing systems in Los Angeles, but all of the properties including power plants within and without the city. It is said that time cures all things, and it is our belief that time will cure even this difficult situation. The companies are willing and anxious to do what they legally can to help the situation in this respect, proposing this co-operative arrangement for such period as is necessary to allow them to replace Los Angeles business with other business, to make full use of their generating plants. They promise to take up in good faith with the trustees of the bondholders, the matter of securing releases of their property at that time. Some of the city officials are insisting upon a a definite option at a fixed price and immediate possession and operation by the city. This, I am informed, is not legally possible, but we are working along, trying to arrive at some solution which will preserve the rights of both parties, prevent the unnecessary duplication of property, and replace turmoil with co-operation.

The power distribution report just published might be thought to have important bearing on the present negotiations with the city, unless it is carefully read in full and thoroughly understood. The report sets forth ideal or theoretical conditions, based upon present business and certain assumptions outlined in the instructions to the engineers, which they have fairly made clear to one familiar with the business, though not entirely plain to the layman. It demonstrates the tremendous advantage to the city of securing the entire Los Angeles market, which is the basis of present negotiations.

The estimate of cost of installing the distributing system is made as of the date of the report, whereas the city's power will not be available before the year 1915. Two years' extensions and additions must therefore be considered. In the proposed distributing system, it has not been deemed desirable to provide for 110-220 volt direct current service. This is a very expensive service, now extensively in use and demanded by consumers. It is used in the operation of elevator motors, modern office buildings are specially wired for it, newspapers and printing press motors use it almost exclusively, as do moving picture shows and theaters for spot lighting. The consumers pay an additional charge of 10 per cent for this service.

The addition of the direct current service, extensions and betterments for two years, and suitable provision for extra cost on account of street congestion, would bring the cost of the distributing system considerably in excess of $9,000,000.

The report is based on a peak load measured at consumers' meters, of approximately 36,000 horsepower, which is stated to be equivalent to the October 1913 load. Considering the losses of current which occur in transmission and distribution from the power house to consumers' meters, the power plant must be sufficient to furnish a peak load of approximately 49,000 h.p. to provide 36,000 h.p. at consumers' meters. The capacity of the city's first installation is estimated at 37,500 h.p. peak load provided there is a constant flow equivalent to 10,000 inches of water through the aqueduct, with 20,000 inches during the period of peak load. Power Plant No. 1 therefore would not be suffi-

cient to provide all of this load, even for the month of October, 1913, and the load for December, 1913, will be materially higher, to say nothing of the substantial increase by December, 1915.

The estimate of annual income is based upon the assumption that approximately 80,000,000 kilowatt hours would be delivered to consumers' meters, and the report says "which assumption means that the city through its distributing system would supply approximately all of the electrical service required in the city of Los Angeles, exclusive of railways." This is evidently not intended to represent competitive conditions as records of other cities where competition exists between municipal and private plants show that the municipal plants serve considerably less than 50 per cent of the business.

No provision is made for steam auxiliary plant to insure continuity of service, and as large consumers must in protection to their own business, take service from the source assuring the best service, the difficulties of building up a large business would be thereby increased.

I am satisfied that in competition with the companies, should such an unfortunate condition be brought about, the city would not secure to exceed 25 per cent of the entire Los Angeles business in addition to street lighting, and exclusive of railways, which on the basis of 1915 consumption would give the city a gross income of approximately $1,200,000, assuming the average rate stated in the report. As against this, the annual cost of operating the distributing system is estimated at $1,263,716, to which must be added the annual cost of operating the power plant of about $410,000, or a total of $1,693,716, plus 12 per cent interest and depreciation on added investment necessary to bring the distributing system up to 1915 conditions.

Under competitive conditions, the city would require to accrue 50 per cent of the business to cover cost with no profit.

SOLICITATION—THE KEYNOTE TO EFFICIENCY

BY R. B. MATEER.

(In this article the author emphasizes the necessity for following up central station advertising matter by systematic solicitation if the most satisfactory results are to be secured from advertising appropriations.—The Editor.)

Many public utilities annually appropriate large sums to purchase bulletins issued by various electrical organizations, for distribution among their consumers with a view to encouraging proper electrical equipment and the efficient use of the service supplied. Such a policy, that of placing printed matter at the disposal of a consuming public generally ends all educational work. The average resident consumer is expected to sit down, read the suggestions on illumination or on power applications and promptly telephone in his order if interested or to cast the literature in the scrap basket, if not. Such a policy, literature by mail, may be deemed suitable or in keeping with the utility but it is true that where results are to be obtained conscientious solicitation combined with demonstration is a necessity.

A large and powerful corporation recently contracted for some 50,000 pamphlets on Illumination. It is supposed they were distributed to some fifty thousand consumers and that modern illumination possible with Mazda high efficiency units replaced the blackened carbon lamps—perhaps affecting the consumers bill and to apparently the detriment of the utility and its earning capacity. How effective such a campaign may be is demonstrated by the experience of one, conversant with modern illumination, and who entering a residence found carbon lamps, everywhere in service yet providing but a feeble yellow light.

Astounded and knowing the efficiency of tungsten lamps, these were made a subject of conversation. An interest aroused, a visit was suggested to the local office of the lighting corporation.

A request for tungsten lamps brought out the reply from the counter clerk, "Can't give 'em to you now. They are locked in the safe and I don't have the key. We'll send them up tomorrow."

The precautions to safeguard a few lamps, improved units of illumination, everywhere in use through Pacific Coast states and the delay in promptly delivering the lamps speak for themselves. Of what use is literature, even though read and digested, when any utility fails to encourage through an aggressive policy, demonstration and delivery, the value of the article advertised.

The same amount of money spent in aggressive solicitation by house to house canvas would have resulted in a number of well lighted homes, each a salesman for the local utility. Each home an actual demonstration of a desire on the part of the corporation to grow with the times, living to up-to-date modern and efficient applications of current. Each tungsten lamp properly installed would be a visible token of a co-operative spirit between utility and consumer —yet no policy breathing such a spirit of friendliness on the part of any company can be developed to its fullest extent by the use of postage stamps. Personal solicitation only will mold opinion and develop confidence on the part of the public in quasi-public utilities.

Perhaps such a condition of affairs is due to a lack of knowledge of the character of installations in the home; perhaps it is the result of permitting the consumer to buy "juice" not service; or it may be the result of a narrow policy of business development in employing those who fail to make their company's welfare their own, yet it is a fact that to secure results, solicitation by capable salesmen must go hand in hand with efficient advertising. Each augments the efficiency of the other. Can such a policy as found to exist in an eastern corporation have place long on the Pacific Coast? Why not expend money judiciously in SOLICITATION; establishing and maintaining a comprehensive record of all consumers in your district; records that show the character of the load of each consumer's place of business and home, and by frequent calls upon present consumers and non-users, render your advertising effective?

JOURNAL OF ELECTRICITY
POWER AND GAS

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C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

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Single Copies, Current Month	each	.25

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1890.
Entry changed May 1. 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

The Electrical Jobber

To the manufacturer reaching out after national business there comes the question of the best manner of marketing his product. There are several methods which might be followed with more or less of success, one which has proven successful in the sale of electrical stock supplies, or shelf-goods, being localized distribution through the electrical jobber. In selling such shelf-goods the way to non-success lies along the road of manufacturers' sales direct to retailer or consumer; first because it costs more and second because his competitors selling through the jobber are able to make a lower price. They are also free to devote their energies to the perfection of product, the extension of markets, and more intensive cultivation of the existing trade.

Waiting for eastern shipments is a prolific source of discontent, discouragement, misunderstanding and loss. The jobber with his local stocks is able to give prompt deliveries with the consequent satisfaction and gain to all.

The retailer who persistently purchases through the jobber is paving the way for further price reductions which this procedure makes possible.

Furthermore a jobbers' corps of salesmen are able to cover the territory with a fine tooth comb. They are able to do this because of the diversity of the lines sold. Their frequent visits also contribute to increased sales as also does their acquaintance with the trade; it is not necessary for them to get to know the trade, a function of the manufacturers' salesman, which often makes deep inroads into the time allowed at each place during the annual visit. From year to year these manufacturers' salesmen are changed and the whole procedure has to be repeated. Considerable business is secured by the jobbers' salesmen because of this thorough covering of the territory which the manufacturers' saleman who is able economically to make only the larger cities, would otherwise lose.

Furthermore, there is the question of credits and accounts. From the East to the Pacific Coast is too long a distance over which to pass on credits—something like an attempt to govern the United States from across the Atlantic—and orders delayed from this cause might often aggravate a Boston tea-party with the manufacturer's goods. In addition to selling, the jobber bears the burden of passing on credits, carrying accounts, and making collections, and with his larger knowledge of local trade conditions together with capital for his purpose and superior facilities has become an economic necessity and the essence of service in the sale of goods electrical.

During the past period of financial stringency those who had unfortunately bought direct from factory realized that a seeming gain might through circumstances be converted into a permanent loss. It pays to buy wisely and conservatively.

The manufacturers, being the first to retrench, could not carry their customers' accounts for any great period and as a result, many of these direct purchasers were forced to the wall. On the other hand, there were many more who purchasing from the jobber were carried up to the extreme limit of their credit.

It is admittedly the province of the manufacturer to find a market for his goods through persistent ad-

vertising, educational work, and missionary endeavor, and if he does this and in addition co-operates with the jobber he will find that success in selling shelf-goods in the West is positively assured.

The Technical Journal

A high class technical journal is not something to be passed up as particularly dry, allowed to age in its wrapper, or opened only to entertain a client. Where such neglect does obtain it is the result of a false concept and not of any failure of the thing itself.

Those who realize all that the technical journal contains for them and the manner in which the knowledge imparted contributes to their efficiency and the advancement of their interests, await each issue with impatience, devour it with avidity and always like Oliver Twist, come back for more.

The race moves forward with rapidity and if you would be an authority—an individual operating at highest efficiency—it is necessary that you too read the record of achievement, which a high class technical journal presents as it occurs. Then when occasion arises your problems will be solved much more readily because of your knowledge of what has been done before.

To be completely satisfied with the technical knowledge you now have is to telegraph ahead your intention not to arrive. To mentally agree to surrender your task for others to complete while you are yet in your prime.

Imagine an engineer who graduated in eighty-two saying that he "subscribed for, but had no time to read the technical magazines." The leading engineers of the day, the men with their fingers on the pulse of mighty projects which their brains originate and carry through to a successful issue, not only read, but usually tear-up one copy of each technical magazine from which articles of especial interest are culled and filed for future reference, while others preserve complete files indexed for easy reference.

"Too busy to read" cramps intellect and limits understanding.

The man who is always busy—that is, busy doing things—certainly learns something. May be getting a good advancing education, but if he concentrates only on this his horizon is limited and the necessity for tackling some other phase might prove a knockout blow in his professional solar plexus.

The minds of men of many and diverse occupations contribute to the pages of the technical press and so give variety. These men rank high each in his particular specialty and so make the journal an authority and confer upon the readers exceptional educational advantages.

The technical magazine symbolizes technical education.

Technical education is not something for the expert alone. It is for all men engaged in the particular trade, occupation or profession considered and not for the favored few. Articles of all degree therefore find entrance. The art and science are perhaps most prominent but the allied trades and occupations gain also their legitimate place.

New Water Power Bill

What is stated to be a conservative water power bill has been planned by the House committee on interstate and foreign commerce, and is so framed to steer a middle course between the extreme state's-rights supporters and the federalists. It is expected that the bill will be introduced this week.

From long range it appears that this bill is based upon the opinion that public lands should be retained in public ownership and controlled by the federal government. It will therefore open up for thorough and friendly discussion in Congress the facts pertaining to the controversial subject of conservation and the proper determination of state and federal rights. It should tend to eliminate the apparent uncertainty which now exists in connection with water power developments.

Necessary development is urgent at all times, should contain no element of uncertainty, and be always properly protected. The theory of conservation must be harmonized with practical requirements.

The bill contains two major provisions, one of which is that there must be the largest possible use of water on navigable streams and the other relates to the leasing of power. It provides for fifty year leases with renewal privileges and also for protection of properties by the lessee.

It further provides for three classes of charges. These are reimbursement of the government for any expense it may incur, rentals, and costs incident to restoring streams to their former navigability. Under the rental provisions the bill contemplates payment for the use for power purposes of government constructed reservoirs and for the use of government lands utilized for power purposes including forest reserves of the West.

The determination of the position of the government in arriving at charges to lessees for the power generated is to be left to discussion in both houses of Congress. The extreme state's-rights supporters want no charges whatsoever; while the federalists favor liberal charges, first on the ground of their claim that the interstate commerce clause of the constitution will govern where power is transmitted across state borders, and second, the conditions of the contracts under which franchises are granted. These franchises must however be subject to state laws regulating public utilities.

If C. P. Steinmetz's nation-wide transmission system, analogous to our railways, is the vision of a scientific mind in the vanguard of electrical development, then this will, even if only partially realized, result in a considerable increase in interstate commerce in hydroelectric energy sales. With such a development, the federal government must of necessity take an active part as arbiter and harmonizer.

The only true conservation of water powers consists in their complete utilization in the interests of all.

If this new bill serves to stimulate development where present acts of Congress seem to retard them much good will have been accomplished. It is hoped that the outcome will be to this end.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. C. Goldrick, manager Kellogg Switchboard & Supply Company, San Francisco, is at Vancouver, B. C.

J. D. Galloway, consulting civil engineer of San Francisco, has returned after traveling five months in Europe.

Fred Poss, Pacific Coast manager for the Benjamin Electric Manufacturing Company, spent the past week at Los Angeles.

J. M. Kearney, Western Electric specialist, of New York, handling W. N. Mathews' line, arrived in San Francisco the first part of the week.

Garnett Young, manager of the Telephone & Electric Equipment Company, has returned to San Francisco from an extended Eastern trip.

Burnett Goodwin, recently elected Jovian Statesman at Portland, Oregon, expects to hold a big Rejuvenation at Portland in the near future.

H. M. Irwin, assistant to the treasurer of Westinghouse Electric and Manufacturing Company, left the first part of the week for a business trip to Seattle.

Franklin T. Griffith, president of the Portland Railway, Light & Power Company, is expected to return this week from a conference with C. M. Clark at Philadelphia.

Robert A. McKee, chief engineer of the steam turbine department of the Allis-Chalmers Company, is expected on the Pacific Coast in a series of visitations to their various coast offices.

Wynn Meredith, Pacific Coast firm member of Sanderson & Porter, is expected to return to San Francisco this week from Victoria, B. C., his first trip since a recent operation for appendicitis.

Elgin Stoddard, vice-president of Chas. C. Moore & Company, Engineers, has returned to San Francisco from a trip to the northwest, where he visited the Portland and Seattle offices of the company.

F. E. Blake, general manager of the Hawaiian Electric Company, Ltd., Honolulu, after an extended trip through the East, has been spending the last week in San Francisco, and will attend the Del Monte Jobbers' meeting before returning home.

W. S. Greenfield, manager of the H. W. Johns-Manville Company, San Francisco, left during the latter part of the week for an extended business trip through Northern California, accompanied by **W. R. Jones**, manager of the Government Department of the same company.

Kirk W. Eichelberger, from the San Francisco office of Chas. C. Moore & Company, Engineers, has returned to San Francisco after a successful two weeks' trip through the northwest. Mr. Eichelberger is specializing on Smith, Vaile Pumping Machinery, as manufactured by the Platt Iron Works Company.

Ray Fulcher, civil engineer, has returned to the San Francisco office of Sanderson & Porter, after negotiating with the Edmonton, Alberta, city officials relative to their contracting to take a large block of the power which his company contemplates developing in the Rocky Mountains, two hundred and fifty miles distant.

Ross Hartley, manager of the Portland branch, **C. H. Carter** of the Los Angeles branch, and **F. W. Killam** of the Seattle branch of the Pacific States Electric Company, have been in San Francisco for the past week attending a district managers' meeting of their organization, after which they visited the Jobbers' meeting at Del Monte, December 4 to 6.

E. A. Finkbeiner, late of the engineering force of the Platt Iron Works Company, and specializing on water wheels and other hydraulic machinery, has become associated with Chas. C. Moore & Company, Engineers, and will be permanently attached to the Portland office of the company from which point he will look after the hydraulic installations made by this company.

MEETING NOTICES.

Oregon Electrical Contractors' Association.

The regular meeting of the Oregon Electrical Contractors' Association was held at the Portland Commercial Club at 6:30 p. m. on the evening of November 26, 1913. Refreshments were served and the regular routine of business was transacted.

Portland Association, A. S. C. E.

The Portland Association of the members of the American Society of Civil Engineers held their regular meeting on November 24th, and discussed the question of "Quantity Surveys." The meeting was well attended and the discussions were extended.

Portland Sections A. I. E. E. and N. E. L. A.

A meeting of the above associations took place on Tuesday evening, December 2d, at the Hawthorne building, the meeting being presided over by Mr. E. A. West. The subject of the evening, "Recent Regulating Measures Affecting Public Utilities," was presented by Mr. O. B. Coldwell, General Superintendent of the Portland Railway, Light and Power Company; H. R. Wakeman, C. E. Condit, D. F. McGee, W. D. Scott and W. H. Evans took part in the discussion.

Utah Electric Club.

At the regular weekly luncheon of the Utah Electric Club at the Commercial Club Thursday, Wm. M. Scott, superintendent of lines and electric service, was the principal speaker. His subject was "The Reconstruction of the Salt Lake City Distribution System." He outlined the changes and improvements which have been made during the past six years in substituting a feeder and main system of distributions for the old ring distribution system. Fifty club members were present.

Electrical Development League of Alameda County.

The Electrical Development League of Alameda County held its regular monthly meeting at 1:15 p. m. Saturday, November 29th. The following officers were elected for the coming year: George Furniss, Pacific Gas & Electric Company, president; B. B. Hlil, inspector, Oakland City Electric Department, first vice-president; P. H. Gribble, Kimball Electric Company, second vice-president; G. G. Drew, Pacific States Electric Company, secretary. The speaker of the day was W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company, who read an inspiring paper on Co-operation. Fifty-five members attended the meeting.

Southern California Jovian Electrical League.

The regular weekly meeting of the Jovian Electrical League of Southern California, was held at Christopher's with an attendance of ninety members, Mr. Chas. H. Carter officiating as chairman. Harry N. Sessions delivered an impromptu talk on "Storage Batteries" and Mr. Ernest Ingold, president of the Los Angeles Ad. Club, gave a talk on "The Law of Attention Hitched Onto an Electric Sign." Mr. Ingold outlined the fundamental principles of the laws of attention as applied to retail advertising, and his speech was thoroughly appreciated and enjoyed by all. Two vaudeville acts kindly furnished by the manager of Pantages Theatre, concluded the program.

Electrical Development and Jovian League.

The regular Tuesday meeting of the Electrical Development and Jovian League of San Francisco on December 2 was held at Fred Solari's Cafe under the Jovian Order,

Statesman A. E. Rowe presiding. The Jovians had provided some excellent entertainers whose presence greatly enlivened the meeting. Reigning Vulcan A. H. Halloran gave a report of the rejuvenation at Stockton. Harry Rice of Cleveland made a stirring address and P. B. Hyde, chairman of the membership committee for the forthcoming rejuvenation on January 10th gave an account of the work being done by this committee. Gate prizes in the form of an electric radiant grill, electric iron and electric toaster, were won by W. W. Hanscom, Paul Butte and B. M. Smarr, respectively. The attendance was nearly 100 and the meeting one of the most successful of the year.

STOCKTON JOVIAN REJUVENATION.

A rejuvenation of the Jovian Order was held at Stockton, Cal., on November 29th, under the joint auspices of A. E. Rowe, Statesman for San Francisco, and G. S. Pearce, Statesman for Sacramento. There was a large and enthusiastic attendance of Jovians from San Francisco and Sacramento to welcome and care for the nineteen newly made rejuvenated beings.

The rejuvenation was held in the Moose Hall, the work being done by the following team:

Jupiter, A. H. Halloran	Hercules, L. A. Schloss
Neptune, G. S. Pearce	Mars, P. B. Hyde
Pluto, A. E. Rowe	Apollo, W. S. Hanbridge
Vulcan, F. D. Fagan	Mercury, S. L. Hawkins

Avrenim, Murray Orrick.
Imps, J. A. Herr, G. D. Jones, W. C. Dolan, A. E. Commerford.

The rendition of the ritual was most excellent, especially considering the fact that only one member of the team had previously occupied the same position.

At the conclusion of the ceremonies an elaborate banquet was served at Madden's Cafe. Concluding the banquet, speeches were made by a large number of Jovians, including L. F. Youdall, who gave an address of welcome; A. H. Halloran, who spoke on the aims and purposes of the order; W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company who gave a straight-from-the-shoulder talk on Co-Operation; C. V. Schneider, president of the contractors' association; Noble Powell, one of the more prominent contractors; W. S. Hanbridge, secretary of the association and Statesmen Rowe and Pearce. A. E. Commerford acted as toastmaster.

The following were initiated and are now fully constituted members of the Jovian Order:

H. H. Adams, division manager, Oro Electric Corporation, Stockton.

J. H. Fagg, assistant superintendent, Pacific Gas & Electric Company, Stockton.

A. F. Flannagan, manager, Electrical Engineering & Supply Company, Stockton.

A. J. K. Gnekow, partner, Commeford & Gnekow, Stockton.

C. O. Gould, manager, Gould's Light House, Stockton.

A. S. Harrington, manager, New Business Department, Western States Gas & Electric Company, Stockton.

W. S. Heger Jr., engineer and contractor, Sacramento.

W. L. McDonell, superintendent construction, Electrical Supply Company, Sacramento.

Wm. A. Murphy, City Electrician, Stockton.

W. C. North, salesman, General Electric Company, San Francisco.

E. R. Pahntag, salesman, Dunham, Carrigan & Hayden Company, San Francisco.

J. A. Patzer, proprietor, Patzer's Electric Works, Stockton.

N. D. Powell, electrical contractor, Noble D. Powell Company, Stockton.

G. N. Somerville, electric salesman, Sterling Iron Works, Stockton.

J. O. Tobey, division superintendent, Pacific Gas & Electric Company, Sacramento.

G. W. Treinor, partner, Waltz & Treinor Electric Company, Stockton.

H. E. Waltz, manager, Waltz & Treinor Electric Company, Stockton.

F. G. Van Booskirk, H. W. Johns-Manville Company, Stockton.

L. F. Youdall, manager, Electric Machine Equipment Company, Stockton.

This rejuvenation is but the first of several which Statesman Rowe has planned for the near future. On January 10th he has scheduled a large rejuvenation to be held in San Francisco and he is bending every effort toward placing San Francisco at the head of the list and thus aid in bringing the annual convention to San Francisco in 1915.

TRADE NOTES.

NePage, McKenny & Company, 325 Yesler Way, Seattle, are rewiring the six-story Pacific building at Occidental and Yesler Way.

The W. H. Smith Electrical Engineering Company, Spalding building, Portland, has been awarded the contract for the electrical work in the Pittock building being erected in that city.

The Summerland Telephone Company, Limited, Summerland, B. C., has placed an order with the Kellogg Switchboard & Supply Company for a complete common battery system.

Evans-Dickson Company, electrical engineers and contractors, have secured the contract for electric work on the Lincoln Park high school at Tacoma, amounting to approximately $10,000. This calls for telephones, call bell wiring, light wiring, switchboards, etc.

The Wagner Electric Manufacturing Company, St. Louis, announces through its New York office, 30 Church street, that they have made arrangements with E. I. Van Doren, 343 River street, Troy, N. Y., to handle the sale of Wagner products in Troy and vicinity.

The switchboard for the Elwha power plant of the Olympic Power Company, Port Angeles, Washington, has been completed and nearly all of the apparatus has been delivered for the Hoods Canal and Bremerton substations. These were supplied by the Westinghouse Electric & Manufacturing Company.

The Allis-Chalmers Manufacturing Company has secured the Wheeler Lumber Company contract for the following electric motors required to operate its new lumber mill at Wheeler, Oregon; 2-2 h.p. squirrel cage motors for driving fling room machinery; 5-3 h.p. squirrel cage motors for driving swing up saws and filing room machinery; 2-5 h.p. squirrel cage motors for driving transfers; 10-7½ h.p. squirrel cage motors for driving transfers and lumber sorter; 1-10 h.p. squirrel cage motor for driving fuel conveyor; 1-20 h.p. squirrel cage motor for driving planing machine; 2-25 h.p. squirrel cage motors for driving fans and vertical resaw; 1-30 h.p. squirrel cage motor for driving planing mill machinery; 1-50 h.p. squirrel cage motor for driving planing mill machinery; 1-35 h.p. slip ring motor for driving unloader; 2-65 h.p. squirrel cage motors for driving planing machines; 1-75 h.p. squirrel cage motor for driving fan; 2-40 k.v.a. lighting transformers; 2-15 k.v.a. lighting transformers.

Oregon Society of Engineers.

The Board of Higher Curricula of the State of Oregon requested the Oregon Society of Engineers to file with them a brief covering the following points: First, what is an industrial or vocational engineer and what would the society regard as a fair preparation either through a course of study or practice or both. Second, a course of study at the minimum which the society would deem adequate under present conditions to fit a man for the professional degree of engineering, noting at what point in the course candidates for the several special degrees should begin to differentiate in their course and giving the course suitable for the several degrees.

The reason the request was made for the course to be put at its minimum was that the boy of limited means might not be required to pursue a course beyond just what was adequate, the thought being that the course must be ade-

quate in the interest of the public and the profession but must be started at its minimum in the interest of the poor boy.

In order to secure open discussion on the subject of Engineering Education, with special reference to the University of Oregon and the Oregon Agricultural College, the Oregon Society of Engineers held a meeting in Room A of the Multnomah Public Library Building, in Portland, Oregon, on Thursday evening, November 13th, at which time many ideas were expressed both in writing and verbally. Both colleges being well represented. Prior to this meeting, in order to obtain definite recommendations to forward the Board of Higher Curricula, President W. H. Graves of the Oregon Society of Engineers appointed Messrs. H. L. Vorse and F. D. Weber, as a committee to formulate a "tentative course" of study to be followed in order to thoroughly and properly equip a professional electrical engineer for the practice of his profession after graduation.

The two colleges in Oregon have different entrance requirements and have courses of study which vary quite materially, therefore the committee confined itself only to "recommendations" and a "tentative course," and not to the "specific changes" in the above-named colleges in order to improve the present courses of instruction. Also the committee appreciated the fact that the present funds available for engineering education, would also hamper the colleges if they should attempt to carry out immediately all the changes recommended.

The paper as presented at the meeting is as follows:

After due consideration and with the conviction, based on actual experience, that our University and College courses do not train students for the actual and practical needs of a professional electrical engineer—and not at all for a vocational engineer—your committee, in working for a tentative course for professional electrical engineers, begs to report as follows:

First: That the training of a vocational engineer should be left to the public trade school system and should not be a part of the university or college. Schools such as the Portland Trade School and the Lick School of Mechanical Arts, San Francisco, covering that ground in the proper form.

Second: Entrance requirements at both colleges, University of Oregon and Agricultural College should be uniform and require four years High School course, and upon graduation, a uniform degree should be given at both institutions for equivalent courses.

Third: Under graduate courses should be for four years.

Fourth: All mathematics up to calculus to be taught in the High Schools or preparatory schools. Omitting long courses in plane and solid geometry and substitute short courses in geometrical forms and take up the study of trigonometry directly. Abstract mathematics should be avoided. All problems should have practical application all the time and be applied to other subjects besides mathematics such as physics, hydraulics, surveying, etc. We feel that mathematics is taught at the present time in historical sequence and not to produce the best working knowledge for the engineer.

Fifth: Mechanical drawing—instrumental in its nature—and free-hand lettering, etc., should be taught in the High School. The drawing subject to be applied to practical subjects such as bolts and screw heads, etc.

Sixth: Modern languages if taken in the High Schools should be elective and extend over four years and efforts should be concentrated on one language.

Seventh: We would recommend a thorough course in commercial law, business practice and accounting, to be taught in the Preparatory or High Schools.

Eighth: Within the University and College, there should be efforts made to eliminate the practice of inbreeding of instructors and professors who have no practical experience in the subject they endeavor to impart to the prospective engineers.

Ninth: We would recommend for an advance degree work in electrical engineering—two years of extended study divided between the parent institution and travel and study at one or more of the leading institutions of this and in foreign countries.

In the tentative course submitted to the Society we have only been able to outline same, the finer details of application will necessitate years of adjustment.

Tentative Course.

Undergraduate Year.

	Hours. 1st term.	Hours. 2d term.
Mathematics: Calculus limited to that actually used by the engineer and its application to engineering	5	5
Mechanical Drawing: Elements of machine construction. Laboratory course	6	6
General Chemistry: Lecture course	2	2
Wood Work: Laboratory	3	
Pattern-making: Laboratory course		3
Machinery: Assembly and adjustment of simple machines. Laboratory and lecture	6	6
Physics: Lecture	2	2
Hygiene: Gymnasium	1	1
Elect. Courses.		

Sophomore Year.	Hours. 1st Term.	Hours. 2d Term.
Mathematics: Problems in calculus as applied to engineering	2	2
The Elements of Complex Quantities: Its application to electrical engineering	2	2
Business Correspondence: As used by the engineer	1	1
Mechanical Drawing: Installation layouts, foundations, etc.	6	6
Machine Shop Practice	3	3
Machinery Assembly and Adjustments: Extended course	6	6
Wiring: Elementary work details of electrical trade fittings, outside construction, including pole lines in the underground construction. Laboratory and lecture	3	
Inside wiring—Laboratory and lecture		3
Life and fire hazard simple wiring calculation. Underwriters' rules. Lecture	1	1
Personal Hygiene: Lecture and gymnasium	1	1
Elective Courses.		

Junior Year.	Hours. 1st Term.	Hours. 2d Term.
Mathematics: Elements of harmonic motion, Lecture.	1	1
Electrical Engineering: Application of the complex quantities to the solution of problems involving inductance and capacity. Lecture	3	3
Mechanical Drawing: With special reference to the application of electrical machinery in the Industries supplemented by lectures	6	6
Electrical Machinery: Assembly and testing of electrical machinery and equipments. Repair and construction of parts, etc.	6	6
Electrical Measuring Devices: Lecture	1	1
Engineering Law: Contracts, incorporation, etc. Lecture	2	2
Strength of Materials: Principles and application to practical problems, including steel and concrete construction and footings for foundations. Lecture	3	3
Hydraulics: Lecture	2	2
Plane Surveying: Lecture and field work	3	3
Elective Courses.		

Senior Year.	Hours. 1st Term.	Hours. 2d Term.
Electrical Engineering: The theory of the design of dynamo electric machinery motors, transformers, rotary and stationary, etc.	3	3
Mechanical Drawing: Details laying out a complete installation	6	6
Electric Machinery: Testing. Laboratory	3	3
Cost data: Calculation of the cost of complete installation. Valuations of properties. Writing of specifications and contracts. Lecture course	5	5
Thermo Dynamics: Lecture	2	2
Electrical Engineering: Distribution systems, application of power to same, and the various commercial utilizations of power, project work and estimates. Lecture course	3	3
Hydraulic Engineering: The location of reservoirs. Calculation of available power. Estimating watershed areas. Run-off data. Gauging of streams, etc.	3	3
Electrical Courses.		

NEWS NOTES

INCORPORATIONS.

WILLAPA, WASH.—Willapa Valley Telephone Company, $5000, by E. W. Lilly, V. Monohon, C. H. Clapshaw, et al.

FRESNO, CAL.—Fowler Gas Company, $50,000, shares $1 each, subscribed $50, by W. S. Ricketts, J. R. Lovely et al.

RICHLAND, WASH.—Richland Valley farmers have organized a country telephone system called Yakima & Columbia River Telephone Company. E. E. Floyd, president; J. R. Gardener, vice-president; Wm. Read, secretary.

OLYMPIA, WASH.—Articles of incorporation for the Tacoma Transit Company, capitalized at $30,000, have been filed with the secretary of state. The incorporators are J. Grant Hinkle, assistant secretary of state, and Geo. Everett, accountant in the office of Governor Lister.

BOISE, IHADO.—The Swan Creek Electric Power Company has filed articles of incorporation. The principal place of business being Swan Creek, Utah. Capital is $20,000, and the incorporators B. E. Slausser, Salt Lake City, Utah; Ola Transtrum, E. M. Pugmire and Chester Transtrum of St. Charles, Idaho, and Ezra J. Howell of Fish Haven, Idaho.

ILLUMINATION.

MIDVALE, IDAHO.—The Adams County Light & Power Company has petitioned for a light and power plant.

MYTON, UTAH.—R. E. Maxwell has started the excavation for the power plant to be erected by the Myton Electric Company at this place, and the same will now be rushed to completion.

EUREKA, CAL.—The city council has renewed the contract with the Western States Gas & Electric Company for street lighting. The contract specifies 203 or more arc lamps at $60 each per year.

KERRISDALE, POINT GREY, B. C.—Kerrisdale Ratepayers' Association is advocating the establishment of a municipal light and power plant with funds to be raised by the issue of baby bonds.

TACOMA, WASH.—A resolution has been passed providing for the installation of a street lighting system, consisting of metal standards with single globe lamps on each. Objections will be heard December 8th.

NELSON, B. C.—The property owners of Nelson have voted to purchase for $50,000 the Nelson Coke & Gas Company's system. This city now owns its own power plant, waterworks, gas system and street-making plant, and is negotiating for the street railway system.

NATIONAL CITY, CAL.—The Board of Trustees of National City has awarded a contract to the San Diego Consolidated Gas & Electric Company for installing lights and supplying current to 116 lights ot $1.75 per light per month. The contract becomes effective December 15th and covers a period of five years.

EUGENE, ORE.—Over $10,000 to be spent early next spring for the gas main extensions, is outlined in the program for the gas department of the Oregon Power Company for next year, as announced by Superintendent A P. Tillis. Most of the work outlined is the laying of heavy mains ahead of the paving that is expected to be done next year.

VANCOUVER, B. C.—The Vancouver city council has passed a resolution favoring the establishment of a municipal gas plant. The city engineer's estimate is that a plant could be established at an initial cost of $250,000, enabling gas to be sold at $1.16 per thousand, while the minimum price for gas quoted by applicants for a franchise was $1.40.

ASTORIA, ORE.—Engineer Bergsvik reported on the proposition of constructing a municipal power and light plant on the commission's property on the Nehalem River. The engineer stated that a plant could be installed at a cost of $400,000 which would develop double the energy now required to furnish light and power for the city.

STOCKTON, CAL.—The Oro Corporation has filed an application with the commission stating that the city of Stockton is about to invite bids for lighting the streets, municipal buildings and other public places, and that the Oro Electric Corporation desires to submit its bid. Last December the city of Stockton granted to the company a general franchise to operate an electric distribution system within the city. The present application asks that the company be permitted to exercise the privileges granted to it in this franchise in so far as would be necessary to supply electric current to the municipality for the purpose of lighting streets, municipal buildings and other public places.

BOISE, IDAHO.—Competition has developed in southern Idaho between two of the large electric lighting and power companies, the Great Shoshone and Twin Falls Power Company and the Idaho Power & Light Company, formerly the Beaver River Power Company. The former company is seeking to block the latter from entering the Twin Falls district to supply electrical energy, and has applied to the public utilities commission to refuse to grant the Idaho Power Company a certificate of public necessity to extend its lines into the territory referred to. Both companies have large investments in southern Idaho. The Great Shoshone Company is controlled by the Kuhn interests of Pittsburgh. The principal plant is at the Great Shoshone Falls. Its other plants are in course of construction at the Upper and Lower Salmon Falls. The company supplies not only Twin Falls, but Wendell, Jerome, Gooding and Glens Ferry. The Idaho Power & Light Company is controlled by the Nunns. At present it serves Boise and the Boise Valley and a few other Idaho cities with its principal power plant on the Malad River.

TRANSMISSION.

COACHELLA VALLEY, CAL.—The Coachella Valley Ice & Electric Company has applied to the commission for permission to issue its first mortgage 6 per cent bonds of the aggregate face value of $300,000, the proceeds of which are to be devoted to the construction of electric distribution lines in and around Coachella and Imperial Valleys. The Holton Power Company has asked permission to guarantee these bonds and the interest thereon of the Coachella Valley Ice & Electric Company.

OAKLAND, CAL.—The Great Western Power Company has applied to the commission for a certificate of public convenience and necessity to distribute electricity inside the city of Oakland. The application states that the Great Western has heretofore, under franchises granted in 1909, been selling electricity in a portion of Oakland. It now asks for authority to extend its lines and poles, and to construct the necessary equipment to make a general distribution of electricity throughout the city of Oakland.

LOS ANGELES, CAL.—Geo. L. Hoxie of New York, C. L. Cory of Berkeley, and C. W. Koiner of Pasadena, electrical experts who have been investigating the financial side of the municipal electrical distribution system, have filed a report with the city council. The report's approximate

estimates are $5,000,000 for distribution system installation, exclusive of railways; annual cost of operating, including interest, depreciation and sinking fund, $1,850,000; yearly earnings, $2,250,000, with net profits to city, $600,000.

EUGENE, ORE.—The completion of preliminary surveys for the development of 45,000 horsepower within the next five years at Clear Lake, in the Cascade Mountains, 75 miles east of Eugene, has been announced by Geo. S. Enmonston, hydraulic engineer of the Oregon Electric Railroad. The total cost of the installation will be upwards of $5,000,000. Construction of the first unit is to begin about June, 1914. It is proposed to tunnel through the walls of the lake and carry the water in a 10 ft. conduit, a mile and a half under a 500 ft. head to the first power plant.

SAN FRANCISCO, CAL.—The Lake Spaulding dam of the Pacific Gas & Electric Company, in Placer county, is completed. The dam will hold 20,000,000 gallons of water. The waters controlled by this dam will be used in developing electricity six times before they are turned loose on the 75,000 acres of deciduous fruit lands in Placer county for irrigation purposes. The site of Lake Spaulding dam was acquired by the present owners in 1905, and surveys were made the following year. Construction started in July, 1912, and the first concrete was placed in the river bottom November 15th of that year. The last concrete was placed at an elevation of 242 ft., November 17, 1913. The present height of the dam is 242 ft. above the river bed, but work is to commence soon on an addition which will bring the height of the structure to 320 ft., the highest in the world. The project thus far has cost $5,000,000; the completed work will cost $15,000,000.

TRANSPORTATION.

PORTLAND, ORE.—A franchise has been granted the Portland & Oregon City Electric Railway Company to operate cars on streets of the city. Construction work will start immediately.

CLARKSTON, WASH.—A movement to construct between three and four miles of street car line to serve Clarkston and Vineland has been launched at a meeting of the chamber of commerce.

VICTORIA, B. C.—The mayor of Victoria advocates, in view of the recent rise in street car fares by the B. C. Electric Railway, that a Greater Victoria be organized with a view to taking over the system as a public utility.

NORTH YAKIMA, WASH.—Superintendent Drake, Yakima Valley Transportation Company, has asked stockholders of the company for money to make three miles extension of suburban line into Wide Hollow to tap the Tieton district.

PORTLAND, ORE.—The franchise granting to Geo. F. Heusner the right to construct on electric railway line from the Kenton district to the westside business section, has passed the city council. The estimated cost of the line is $350,000.

CENTRALIA, WASH.—The Lewis County Commissioners have granted a franchise to the Washington-Oregon corporation to operate a line from the Galvin station near the fair grounds on South street to the old Union Pacific grade, and thence north to the city limits.

TACOMA, WASH.—December 30th has been set for the date for the special election for the purpose of voting $87,000 worth of bonds to construct and maintain a municipal street car line across the Eleventh street bridge to the manufacturing district on the tide flats.

MILL VALLEY, CAL.—An application has been made to the board of trustees by W. W. Hicks for a street railroad franchise upon certain streets in the town of Mill Valley. Sealed bids will be received by the board of trustees up to January 13, 1914, for the sale of the franchise to the highest bidder.

TACOMA, WASH.—The council has enlarged on its municipal street car program and will submit a proposal on December 30th to get authority to build to all populous points in the city. Only one or possibly two bond issues will be asked for as follows: $87,000 for tide flats line and $63,000 for the Sixth avenue extension.

RIVERSIDE, CAL.—The Riverside County Supervisors and the property owners of that county have made possible, the immediate construction of the Riverside-Corona extension of the Pacific Electric system. The railway company now has a deeded right-of-way from the Riverside City limits to Corona. The Riverside-San Bernardino electrification has been practically completed, but regular schedule has not been established, pending the completion of the San Bernardino-Los Angeles extension.

SAN FRANCISCO, CAL.—The public utilities committee of the supervisors has decided that the city shall take over the Union street line on December 11, when the franchise of the Presidio & Ferries Railroad Company expires, and that the road shall be run as a part of the municipal railway system. The matter of fixing the value of the property and paying for it are regarded as details which can be settled afterward. The intention is to have the operation of the road continue as usual until the city officials get ready to reconstruct it.

OAKLAND, CAL.—A deed of trust has been filed for the Oakland, Antioch & Eastern Railway making the Union Trust Company of San Francisco trustee for a bond issue of $5,000,000. The deed of trust conveys to the trustee all the property of the company, including "right of way through Contra Costa and San Joaquin counties into the city of Stockton, which the corporation now holds or which it may hereafter acquire." The filing of the document has given rise to an unconfirmed rumor to the effect that the Oakland, Antioch & Eastern is perfecting plans for entering Stockton.

SAN FRANCISCO, CAL.—The United Railroads has made arrangements with E. H. Rollins & Sons for the extension for a period of two years of $1,800,000 Market Street Cable Railway 6 per cent bonds, a former extension on which will expire December 15th. Four coupons will be delivered with the bonds and the United Railroads obligates itself to pay the interest at 6 per cent during the extended period, The local bond house will buy all the bonds of this issue offered on December 15th and, after providing for the new extension, offer them to investors at 99½ and interest.

SAN FRANCISCO, CAL.—A rapid transit scheme, involving the construction of an elevated railroad from the ferry and railway lines to outlying districts, has been filed with the supervisors by the Twin Peaks Tunnel Company Property Owners' Association. A diagram, showing the proposed routes, has been prepared by the association's engineer, John M. Punnett. As the proposition includes the joint use by the city of the tracks of the electric line to be constructed by the Southern Pacific on its steam railroad right of way through the Mission and also of the Ocean Shore Railroad Company's tracks, the association suggested that the board create a commission to consider this scheme, consisting of the engineers of the Southern Pacific, Ocean Shore and United Railroads and the city engineer.

BOISE, IDAHO.—The public utilities commission of this state has refused to issue a certificate of public convenience and necessity to the Ashton & St. Anthony Power Company to operate in the city of St. Anthony or in the Egin bench country, which is tributary, through a ruling rendered today. The company is permitted, however, to operate in the towns of Marysville and Ashton in Fremont county and in the territory adjacent to these towns, as franchises had already been secured there. The Utah Power & Light Company, with headquarters in Salt Lake City, which operates in the same territory, was the principal opponent of the application.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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Through a Century

from the hardships and sacrifices of the Mission period in California and the West, to the joys and delights of the approaching Holiday period.

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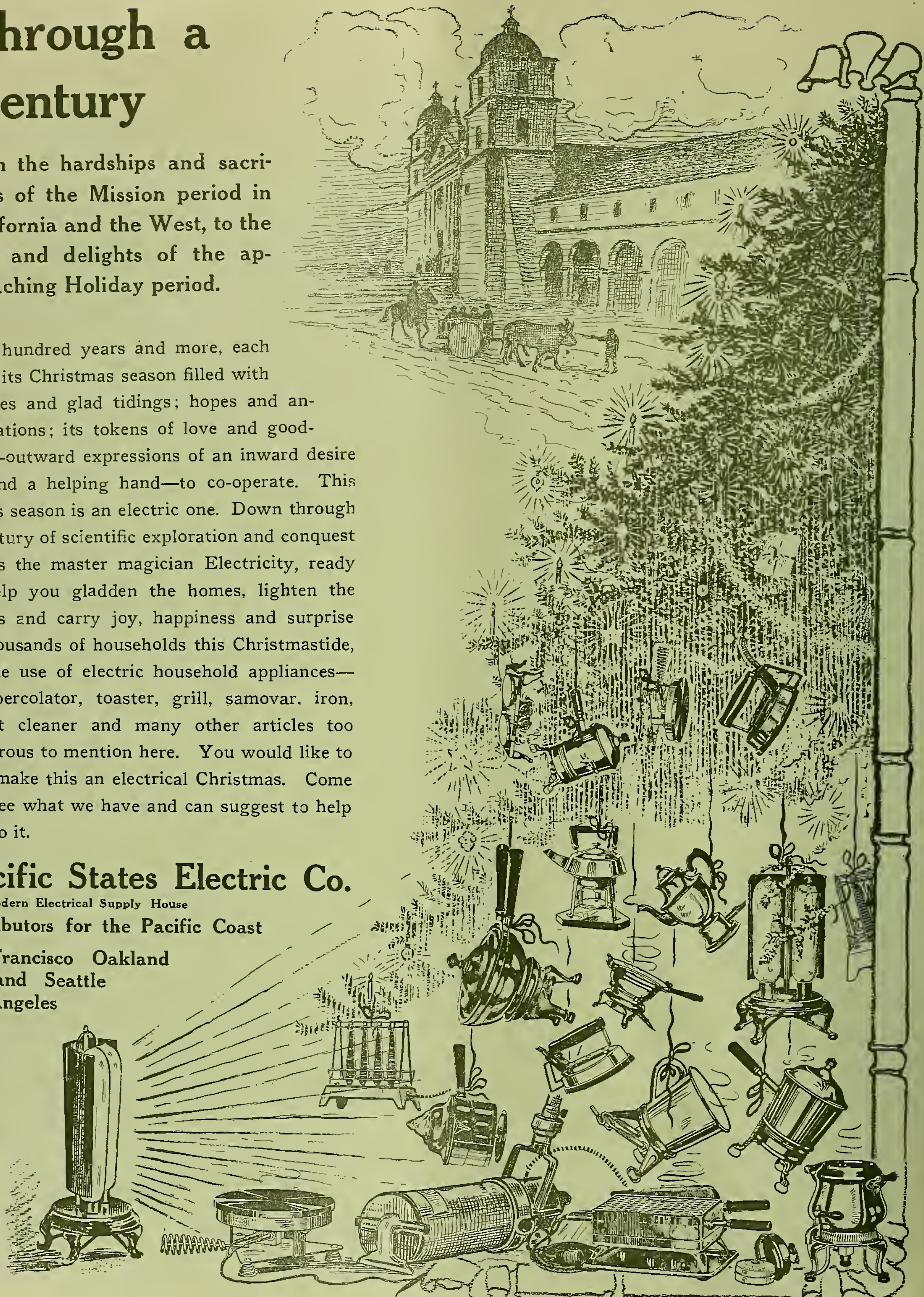

JOURNAL OF ELECTRICITY

POWER AND GAS

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VOLUME XXXI | SAN FRANCISCO, DECEMBER 13, 1913 | NUMBER 24

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LAKE SPAULDING—DRUM POWER DEVELOPMENT

BY RUDOLPH W. VAN NORDEN.

(The subject presented covers the largest hydroelectric development on a single water-shed on the Pacific Coast. It is particularly interesting from the fact that the entire run-off of this water-shed is conserved and used for power seven times, having an aggregate vertical fall of five thousand feet. After leaving the last power plant, the water is used for irrigating over seventy thousand acres of deciduous fruit lands. It is probably the most complete exploitation of a water-shed to be found. The article was written and presented before the San Francisco Section of the American Institute of Electrical Engineers by Rudolph W. Van Norden, Fellow A. I. E. E., Member A. S. C. E.—The Editors.)

There is probably at no place in the world, an example of the total economic use of a watershed more completely exemplified than in the new project of the Pacific Gas & Electric Company, known as the Lake Spaulding-Drum development. A characteristic of California water powers is the high mountain storage of the winter flood waters, to be used during about one-third of the year when the natural runoff becomes a minimum. A second feature found in Western plants is the rapid fall of the rivers, which makes possible a short canal to supply the power plant, together with a high head, as a result of the topography of the country. Both of these features predominate to a marked degree in the South Yuba development.

The new Lake Spaulding development embraces the entire watershed of the South Fork of the Yuba River, above Lake Spaulding; it is the final and complete utilization of this watershed.

The history of the development of these early reservoirs is extremely interesting and forms an important part of the early history of California. For many years the storage system, which embraces the upper reaches of the South Yuba River, was owned by the South Yuba Water Company. This system, by purchase and by construction, from year to year, had acquired up to 1900, twenty-two storage reservoirs with a total capacity of over 1,020,000 miners' inches, which is equivalent to 2,200,000,000 cu. ft. of water.

The area of the South Yuba watershed above Lake Spaulding is 121 square miles. The annual average precipitation over the watershed will vary from forty-three to ninety-five inches. The runoff averages 0.74 of the precipitation. That this variation is marked, enters largely into the economic study of water supply from this source.

The runoff from the watershed varies from 475,-

The Drum Canal About One Mile Below the Outlet Tunnel From the Lake Spaulding Dam.

000 acre feet which occurred in the season 1906-07 to a minimum of 195,000 acre feet which occurred in the season 1911-12. The total capacity of the South Yuba reservoirs was never at any time sufficient to collect more than one-quarter of the runoff, while in years of heavy runoff, over 9 times the capacity of these reservoirs has wasted.

In the year 1905 the property of the South Yuba Water Company and its subsidiary company, the Central California Electric Company, was absorbed by the Pacific Gas & Electric Company. The enormous potential possibilities of the watershed and the topographical aspect of the country which lies below the watershed, for power purposes, and for irrigation were forseen. The site for the new Lake Spaulding dam was selected in 1905 by F. G. Baum and surveyed in 1906 under the direction of J. H. Wise. At this time the physical condition of the South Yuba Company was not of the best and in order to maintain the service requirements which many years of business in supplying water had developed, it was necessary to reconstruct many of the dams, flumes and ditches of the system. Much of this work was under the supervision of the late James H. Wise, who was hydraulic engineer of the company. While Mr. Baum and Mr. Wise familiarized themselves with the physical details of this system, they foresaw the immense potential possibilities, developed a plan for a project which would form the backbone of the already extensive hydroelectric system then in operation. The problem resolved itself into a feasible plan to conserve all of the water which was being wasted during a minimum year. The remainder of the problem of developing power with this water became a simple matter, as nature had provided short distances, heavy falls and the land for cultivation, which could be irrigated by this surplus water.

The Pacific Gas & Electric Company, have, outside of this new development and outside of the watershed, five hydroelectric plants in operation, with three additional, dependent upon this watershed. These plants are on four distinct and separate systems and watersheds; the most northerly being a distance of 120 miles from the most southerly. The amount of power represented in installed machinery in these plants is 77,000 h.p. The system of network which is supplied from these plants has a total line (not circuit) mileage of 1215.8 miles. It covers an area in the central and most populous part of the state of California of 11,800 square miles, which includes the metropolitan district of San Francisco and the east bay cities.

The new Lake Spaulding development is situated about midway with respect to the other power developments.

The amount of average power which will be developed by the new system is nearly three times the total amount of power which has heretofore been developed by all of the other plants. The network to be used and the area to be served by this additional supply of power is identical with that which is being served. It can be readily seen that a problem in the study of power plant economics of the highest order has presented itself here. This study is the complete and most efficient exploration of a watershed. A study of the design of power plants was required, which should not only avail the use of this watershed to its utmost efficiency, but would also serve this system in such a way, that its power will form an economic addition to that which is being supplied from other plants. In other words, that its load factor shall be such as to improve the load factor of other plants and of the system in general, without depreciating its own value as a power producing medium. In order to determine the design for these economic results, it is necessary to thoroughly understand the methods in use in supplying power, the physical, political and municipal restrictions which are present and which must be considered, the existence of present investment and the final economic cost with respect to the results to be obtained.

This entire problem was made a study for some five years by Mr. Wise in which Mr. Baum associated with Mr. Wise, as consulting engineer for the company, collaborated. The decision to begin the development of this project was made in June, 1912, and actual work commenced on July 1, 1912. Some preliminary work, such as surveys and reports had been previously made, but this was to obtain information to enable the company to decide as to feasibility and possibility of carrying forward, so large a project.

Outline of Project.

The development commences at the Lake Spaulding reservoir. This was originally one of the later reservoirs of the old South Yuba Water Company. It was completed in 1892 by John Spaulding, the general superintendent of the South Yuba Water Company and who is more than anybody else identified with the development of that system. (See map page 540.)

This lake has a dam 65 ft. high, of the rock filled type, a fine example of early California practice. The lake is about 9 miles long and very nearly as wide and a capacity of about 270,000,000 cu. ft. It occupies a valley where the banks of the South Yuba spread out and originally formed a meadow. It is situated immediately below the junction of the South Yuba and Fordyce Creek and is the lowest in altitude of the storage reservoirs of the system. Its altitude is 4,880 ft. The flow from the other reservoirs is received, in this lake, on its way to the points of use. Below the old Lake Spaulding dam, the banks of the South Yuba narrow to form a deep gorge or box canyon. This has always been one of the scenic points for this section of California. Within this gorge is a small diverting dam which has, in the past, diverted the flow from the entire storage system into a flume. It is built on a shelf blasted out from the almost vertical cliff of the gorge. This flume is described in some of the earlier accounts of California's industrial progress as being "one of the greatest feats in existence." In the day that it was built, such a statement may have been quite justifiable and even now, one wonders at the temerity of the pioneer miners in accomplishing so substantial a piece of work.

Near the upper end of this gorge and above the diverting dam just mentioned, is an ideal site for a high dam, and here is the key note of the entire development which has taken place. By building a

dam at this point to a height of 305 ft., it is possible to increase the depth, not only of the old Lake Spaulding reservoir, but also of making storage between the old dam and the new dam, so that a capacity of storage of 4,000,000,000 cu. ft. may be had. This additional capacity doubles the available storage of the old system and makes it possible to store all of the flood waters from this watershed in a minimum year.

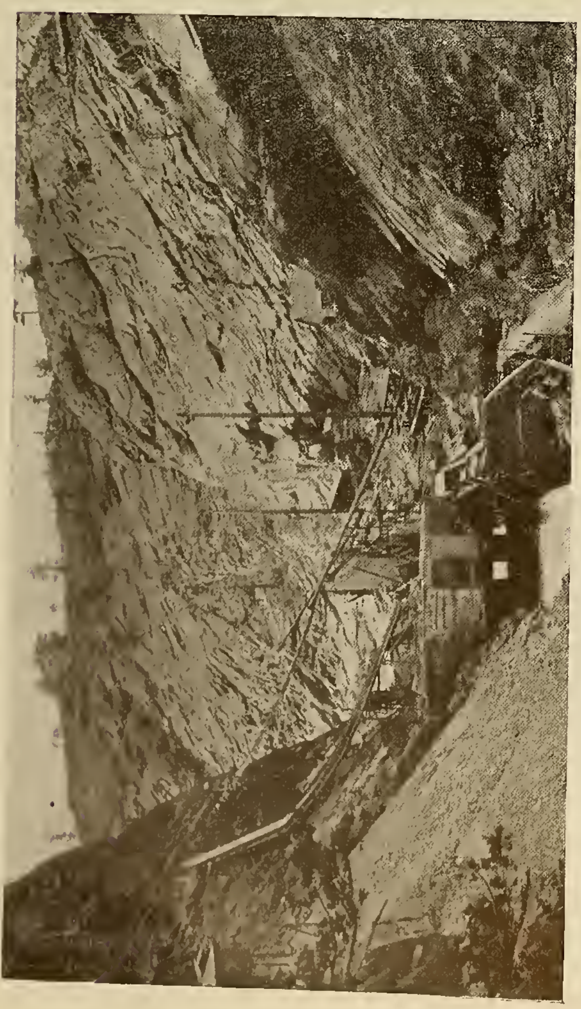
The present draught of water from the system outside of the use of water for the new Drum plant is about 175 cu. ft. per second for average years. It is possible with the use of the additional storage, to increase this draught in a year of minimum flow to 270 cu. ft. per second, or in average years to 350 cu. ft. per second and in a maximum year to 400 cu. ft. per second. With this reservoir, then, the possibility of an entirely new additional flow, for purposes outside of the uses heretofore made of the water from this watershed, immediately becomes available. The water from the new Lake Spaulding reservoir has its outlet through a tunnel whose length is 4600 ft. This has been bored through the solid granite of the hill which forms the south side of the gorge. By a curious freak of topography, the South Yuba River after leaving the gorge, turns north. It is probable that at one time it maintained its generally southwestern direction passing through what is now Bear Valley and the Bear River Canyon. At sometime, due to some cosmic disturbance, the river bed was cut below the point of entrance to Bear Valley and forced its way through the hills to the north. At any rate, it now follows the gorge of the South Yuba and eventually joins the Main Yuba above Smartsville. The outlet from Lake Spaulding is at the head of Bear Valley which is also at or near the source of the Bear River. From this point an open canal carries the water, following the hillside above Bear Valley, and then the Bear River canyon for a distance of nine miles until the grade of the canal and the slope of the longitudinal ridge meet. There is a peculiar characteristic of these ridges, in that, as the ridge gradually lessens in altitude, the outlines become broken, into a series of buttes. Such a condition is presented where the canal meets the top of the ridge so that it is necessary to carry it across the first gap in order to seek its level again by an inverted siphon. Beyond this siphon is the forebay for the Drum power development, the largest power plant of the series.

Going back to the dam, the difference in level between the full lake and the outlet tunnel is 230 ft. As this lake will be full for several months of each year, and as it will require the remainder of the year to draw down to the outlet tunnel level, there will be a period probably of eight or nine months when the head between the surface of the lake and the outlet tunnel will be available for power. Particularly is this valuable because this power will be available for a large part of the time when there may be a shortage of power at other points. This drop will develop power under full head to about 6500 h.p. A power plant has been introduced in the tunnel itself. This plant is located about 1000 ft. from the mouth of the tunnel and some 800 ft. below the dam measured along the river. A cavity was made above the tunnel in the solid rock. From the intake to this cavity the tunnel is necessarily under pressure and has been lined with concrete of which a small portion is reinforced. Just before reaching the power house cavity an uplift has been made in which a steel pipe is carried from the tunnel proper through the uplift into the power house cavity. This pipe will lead directly to a Francis turbine which will be direct connected to a 5500 kw. generator. There are also 2-36 in. relief valves. Both the relief valves and the turbine will discharge back into the tunnel, which is below the power house floor. The flow therefore into the tunnel must pass either through the turbine or through the relief valves. Just below the power house and entering the tunnel is an adit which primarily was used to assist in the construction of the tunnel. The adit is now used as a surge outlet and also as a waste way. From this point to the lower portal the tunnel is unlined, it being in solid rock of a very permanent character and further support or lining has not been deemed necessary.

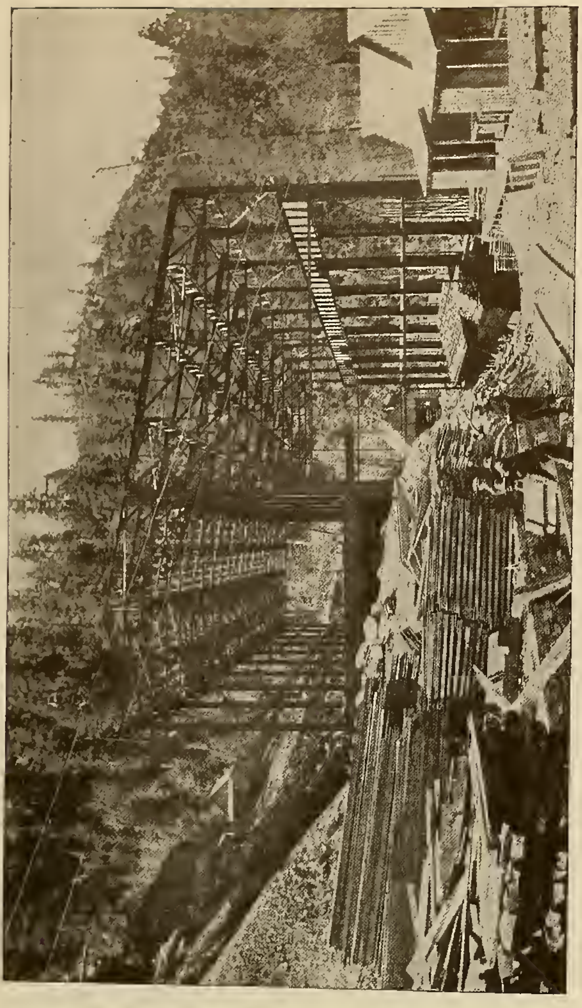
The Drum plant is located on the south side of Bear River. There are to be two pipe lines from the forebay to the power house, but one having been so far installed. These pipes each have a capacity of 300 sec. ft., with a diameter at the top of six feet and taper through three diameters to 52 in. The total hydrostatic head is 1375 ft. and the length of the pipe line is 6200 ft. For about two-thirds of the distance the grade on the pipe line is not great and at one point there is a siphon but the remaining one-third of the distance the grade is at a maximum angle of 40 degrees with the horizontal or about 80 per cent.

The forebay has a capacity of 399 acre feet and is sufficient to operate the power plant for about nine hours in case the water supply should entirely cease. This is in addition to the storage requirement for operating the plant to full capacity over peak loads.

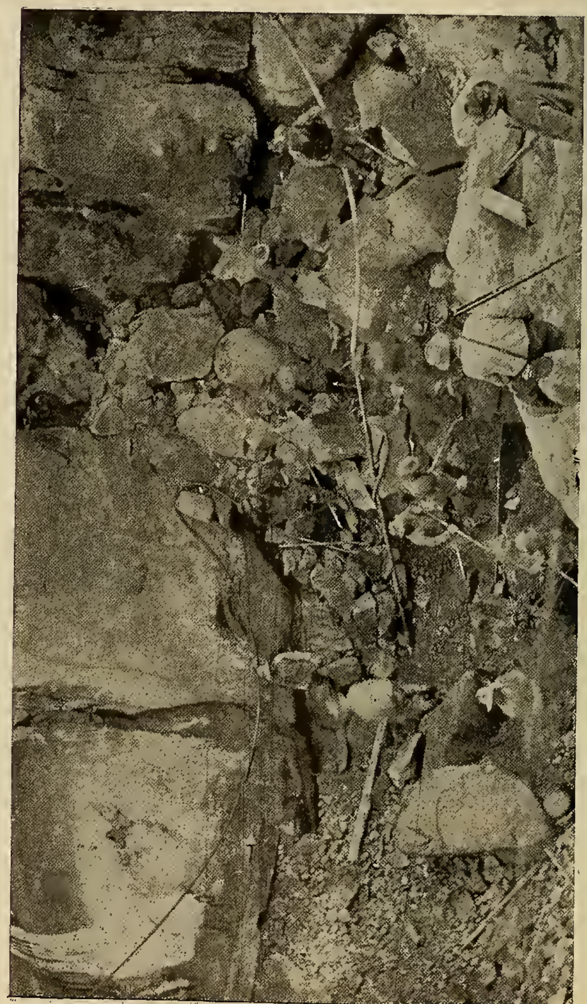
The Drum power house will have an ultimate capacity of 50,000 kw. This will be divided into four main generating units of 12,500 kw. each. In determining the size and number of units for this plant it was necessary to make a very careful study of the load conditions which would probably obtain at this point. The average flow of water is sufficient to maintain a load of 28,000 kw. and it has been found that the station load factor due to a combination of complex conditions should be about 68 per cent. This will vary during different periods of the year but the figure given is an average which it has been estimated by the company engineers, will give a daily load variation between 15,000 kw. and 50,000 kw. Upon this basis, therefore, the plant has been designed to operate when necessary, at the higher value. The power house has been built and finished for the complete installation with the exception of the transformers and generators. In this respect one-half of the installation has been made and is now in operation, the other half amounting to 25,000 kw. will be installed in the near future. Water as it is discharged into the Bear River from the Drum plant will be diverted into a canal, this time on the north bank of Bear River. This canal will have a length of 8.5 miles to the point of the second drop. At this point, there is a fall of 826 ft. and power house No. 2 will



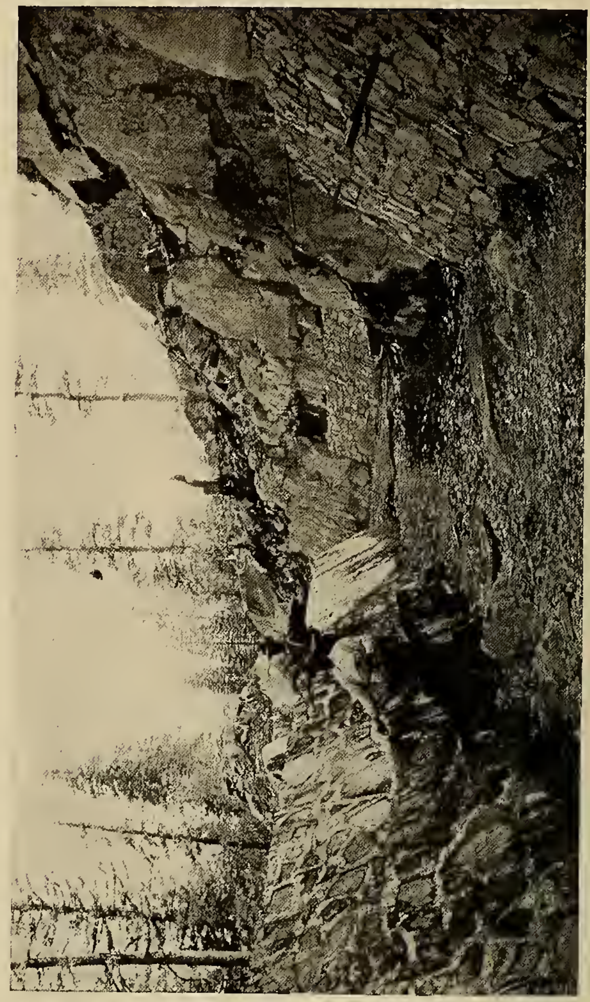
The Lake Spaulding Dam Site Looking Down Stream, Showing the Preliminary Work and Foundations Completed in 1912.



Steel Frame Structure for Drum Power House.



Clearing Bedrock for Foundation of Lake Spaulding Dam.



Building Masonry Wall in Lake Spaulding-Drum Canal.

be placed at the edge of Bear River but on the north side. Here the water will be again taken up and a third canal on the same side of the river will continue a distance of 9.0 miles until a third drop is reached. Here a fall of 500 ft. will be possible with the power house situated in a similar manner to No. 2.

The power installation in No. 2 plant will be in two units of 12,500 k.v.a. each; that of No. 3 plant will be in two units of 8000 k.v.a each. From No. 3 power house the water will be allowed to discharge into Bear River and will follow this stream for a distance of two miles, before being again diverted.

The old diversion from Bear River which was made in 1852 as the commencement and a part of the Bear River and Auburn Mining and Water Company, and which was referred to at the beginning of this description, is to act as the continuation of the Lake Spaulding development.

During the years of 1912 and '13, the canal leading from this diversion and for a distance of 23 miles was enlarged from the original section which had a capacity of about 40 cu. ft. per second to a new section having a capacity of 350 cu. ft. per second. This enlargement was made in view of the additional amount of water which would be delivered into the river from the new plants to be again taken up for further use, as well as to carry the natural water of Bear River, within the limit of water rights owned by the company. In making the enlargement of this canal, about nine miles was eliminated by constructing two tunnels, whose total length is less than one mile. A section of new canal including a tunnel, was built at the end of this enlargement for a distance of one mile to a point where a reservoir has been constructed, known as the No. 4 Regulating reservoir and which has a capacity of 885 acre ft. There are two earth dams in this reservoir, as its site was originally a valley which required closing at both ends. This reservoir forms not only a small storage on the line of canal, but is also a forebay for power plant No. 4. The pressure line to this plant starts from the reservoir in a tunnel or as a matter of fact two tunnels, whose portals are separated by 250 ft. of wood stave pipe 8 ft. in diameter. From the lower portal of the second tunnel a wood stave pipe 8 ft. in diameter follows the contour of the hill for a short distance and then drops to the power house, giving a total fall from the surface of the reservoir of 342 ft. The total length of the pressure line is 5364 ft.

Power House No. 4 is located at the edge of Dry Creek, in reality, in the center of a broad field which slopes gently toward the creek. This power house is in architectural design of the general style used at the other of the newer power plants of the system. Like the Drum power house, it is a steel frame building, with reinforced concrete walls and roof. The installation here consists of one main generating unit. The generator is rated at 12,500 k.v.a and is similar in design to the machinery at Drum. On either end of the shaft is a Francis turbine water wheel of 18,000 h.p. The transformer and switch equipment of this plant is similar to that of the Drum plant with the exception that it is in size suitable for a smaller installation.

In Dry Creek below No. 4 power house is a rock filled dam with a masonry face. This forms a small reservoir into which water from the power house is discharged and it also acts as a reservoir from the canal and power system which extends beyond it. From this reservoir the canal is carried partly in open ditch and partly in two tunnels aggregating 3600 ft. in length, to a reservoir which is under construction in Rock Creek. This is purely a storage reservoir and has a capacity of 2000 acre ft.; it is to be formed by a low concrete dam whose maximum height is 40 ft. and the length 900 ft. From this reservoir the canal is continued, its outlet being somewhat above the dam taken from one side of the reservoir. The canal follows a gentle side hill for a distance of 3½ miles until it is within the city limits of Auburn. In this particular section of canal, there is a rock cut, which is of interest from the fact that it required a double cut by the steam shovels which have been employed throughout in this work.

Placed on the top of a narrow ridge is a forebay reservoir for power plant No. 5 into which the canal empties. This forebay is formed by a long concrete wall almost paralleling the ridge of the hill, and has a capacity of 40 acre ft. The pressure line for power house No. 5 probably the longest pipe line of its kind in California, if not anywhere in this country, has a length of 8555 ft.

There is one tunnel which has a length of 504 ft. and this tunnel which will be lined with concrete is 96 in. in diameter and will be under pressure of not over 20 lb. per sq. in.

Power House No. 5 is located at the edge of Auburn Ravine about 1½ miles below the city of Auburn. This power house is similar in appearance and construction to the No. 4 plant, but having a higher head, will have a water wheel capacity of 19,000 h.p. In it will be installed one 12,500 k.v.a. main generating unit. Water from this plant will be discharged into Auburn Ravine but will be immediately diverted by means of a low concrete arch dam into a canal which will follow the side hill for a distance of 4.5 miles until a point is reached where a second drop into Auburn Ravine is possible, this drop will have a fall of 500 ft. and upon the south bank of the ravine will be placed power house No. 6, the last of the seven power houses to be installed on this system. This plant will contain one generating unit of 10,000 kw. capacity. The water discharged from No. 6 will be at an altitude of 430 ft. It is possible to construct canals and to carry this water still further in southerly, northerly and westerly directions, where it will be avaliable for irrigating 75,000 acres of low foothill land. A small part of this land is now under irrigation, but all of it is suitable for the best deciduous fruit culture and its reclamation from a condition of semi-aridity forms a very valuable asset to the growing resources of this already wonderfully productive section.

The power from the various plants will be transmitted at 100,000 volts to the Cordelia switching station. The main line of this transmission will commence at the Drum power house and from this point it follows approximately a tangent to the south side of the Sacramento Valley near Winters, thence it takes a more southerly direction passing across the

Vaca and north of Pleasant valleys, eventually emerging from the hills near the switching station at Cordelia. The total length of this line is 109.5 miles. The connections for other power houses will be made by 3 branch lines. Power house No. 2 is distant about one mile from the main line and will be connected by a loop. Power house No. 3 is slightly further away but will have a similar connection. Power houses 4, 5 and 6 are some distance south of the main line. This will require a branch which will commence with power house No. 4 passing through No. 5, thence to No. 6, and then continuing in practically a tangent line to a sectionalizing and transformer station at Nicolaus. This branch line will have a length of 34 miles, and will operate at 60,000 volts potential. At Nicolaus a junction is made with four transmission feeders of the net work. These are the lines from Colgate power house; the lines from De Sabla and Centerville power houses, and the connections to Sacramento and the auxiliary steam plant at this point. At the terminus of the line at Cordelia are placed single coil tranformers which reduce a line voltage of 100,000 to the network voltage of 60,000, this is the central distribution point for the entire system and is a logical point of delivery for the new power.

It will be impossible in this paper, due to lack of time and space available, to treat the various parts of the new system in any but the most brief detail.

Work Equipment.

In proceeding with so large a construction covering many points as is the case in this project, the works equipment necessary must be very complete and expensive. Camps to the number of 28 have been maintained, many of them from the inception of the work to its completion, while others have been temporary or removable. The commissary department has been very carefully conducted to prevent waste and excessive cost, but it has been the policy of the company throughout, to maintain its camps in the very best manner which good food, material and careful planning could give. This principle has had a noticeable result in high manual efficiency.

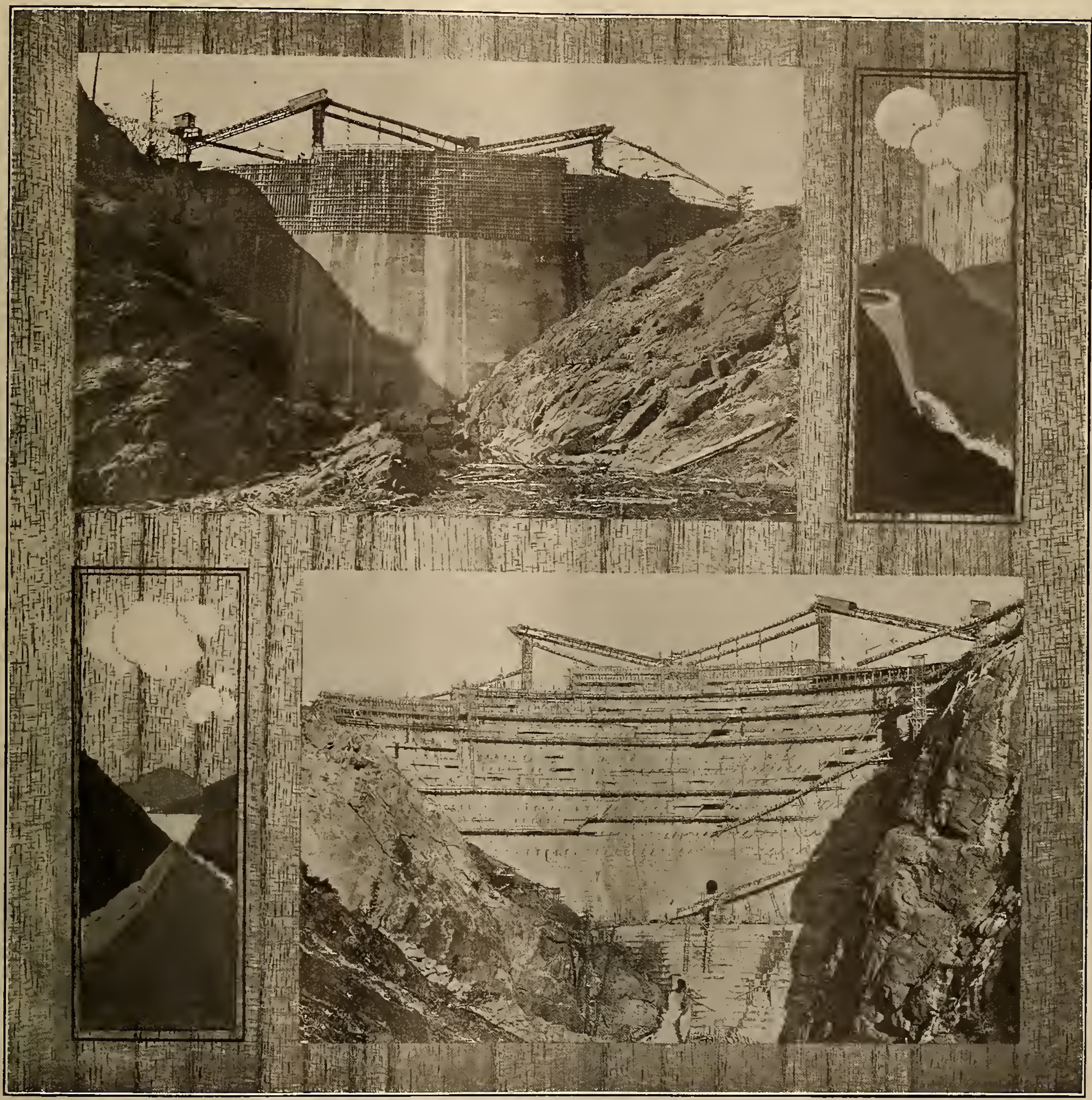
At Lake Spaulding the first requirement was a continuation of a spur track from the Southern Pacific to the location of the new dam. The old spur track, which had a length of one mile and ran to a sawmill was purchased by the company for its own use. The continuation of the track to the dam has a length of 1.3 miles. In some places was encountered rather difficult work of construction and there are three trestles. At the dam site, but somewhat above the crest of the dam, is the works plant, which consists of a compressor house, in which are compressors having a total capacity of 1408 cu. ft. of free air per minute compressed to a pressure of 100 lb. per sq. in. Each of these compressors are driven by a 125 h.p. 440 volt induction motor. At the end of the railroad line and on the side slope of the hill, immediately above the dam are constructed storage bins for the crushed rock and gravel. These have a capacity of 1500 cu. yd. At the extreme end of these bins are two No. 6 McCully gyratory crushers and back of these there is a quarry from which the rock is taken, which is run through the crushers. It is therefore possible to place the crushed rock in the bins or to dump gravel or sand from the cars as may be required. On the lower side of this track and close to the bins is a cement storage house and adjacent to this is a mixer house. The latter is in four stories. Gravel or rock is conveyed from under the bins on belt conveyors to the top of the mixer house and is here distributed into measuring hoppers. The cement is brought in by a belt conveyor from the storage house; and the mixing of the gravel and cement is done on the second floor of the mixer house. On the first floor of the mixer house are four 1½ yard Smith mixers. The remainder of the equipment at this point consists of a machine shop and blacksmith shop. Stretched across the canyon above the dam are two aerial tramways, each having a span of 1400 ft. The suspension cable in each case is 2 in. in diameter and is a special cable of treated plow steel, the strands being of special shape so that they lay perfectly smooth and occupy all of the space. This cable has a breaking strength of 170 tons. At the south end are the operating cabins. These contain a variable speed hoist and traversing line control operated by a 112 h.p. induction motor.

All material except concrete, has been transferred from the head works in the construction of the dam by these cableways. Concrete for the dam has been carried to the point of deposit in wooden chutes.

When the work was first started a patent "U" shaped steel chute was installed, this was found to be totally inadequate to the service required and a simple flume 30 in. wide and 12 in. high, very much like a water flume was substituted to facilitate the flow of concrete. The bottom of this flume was paved with cast iron plates 15 in. wide by 30 in. long; these were cast about ⅝ in. thick. The chutes after leaving the mixers were carried on a slope of 1 to 3 to the edge of the vertical cliff. At first a wood and later a structural steel tower was constructed below the cliff and within these, short sections of chutes constructed as baffles, were built, allowing the concrete to drop to the bottom of the tower where it was discharged into a second chute or series of chutes which distributed it in the dam.

As the crest of the dam raised, chutes were taken from one side of the towers, until a point was reached where the concrete would not flow from the mixers to the towers. In order to distribute the concrete after the dam had risen to the height of 175 ft., a belt elevator was installed on the top of the highest tower and this raised the concrete to a point where it could again be dispersed. A second elevation was later installed, so that concrete could be distributed to the further end of the dam, 50,000 yd. in all being handled in this manner.

Work upon the dam under the charge of Mr. Frank G. Baum, as chief engineer, commenced in the fall of 1912 and lasted until the winter prevented further operation. The work consisted mainly of excavating gravel, and faulty rock and filling the holes and surface irregularities with concrete. It was necessary to make elaborate provisions for handling the water as the canyon is narrow, and by the time that work had actually commenced, water had to be taken care of. This was done at first by a water flume at one side of the canyon, later the outer form of this



Upper and Lower Faces of Lake Spaulding Dam Nearing Completion.

flume was replaced by a concrete wall of sufficient strength to withstand any flood which might come through. Following this a second concrete wall was built and during the winter the river flow was carried between these walls. Across the canyon at the upper toe of the dam a solid concrete wall was built, having a total height of 35 ft; in this wall were installed two temporary openings about 6 ft. square over which were hung timber doors by which the flow of water could be controlled.

It was possible throughout the winter and spring to confine the water between the two walls, this channel was, however, intended only for temporary use and was later filled in solid with concrete.

The actual work of constructing the Lake Spaulding Dam was commenced in the latter part of May of this year. While the plant had been able to show what its capacity might be, it had not been put to any real test.

The material of which the dam has been built has been the subject of much study and some experimentation. When the construction plant was first built there was discovered at a point about midway between the dam and the old spur track to the sawmill, a large deposit of glacial sand. This promised to supply all of the material that would be necessary in the work. It was found that this sand contained a certain amount of silt so that washing became necessary. A heavy hoisting engine with a drag line scraper was installed, and also a washing plant, to which the sand was delivered by an endless belt conveyor. A second sand deposit was discovered on the line of an old lumber narrow gauge railroad, about midway between the main camp and the old Lake Spaulding. Soon after work commenced in the spring of this year, it was found that the sand supply which had been provided while sufficient in quantity, would be totally inadequate to supply the amount of sand

at the required speed necessary within the available cost.

Mr. Baum immediately began to look around for other sources of sand supplies. In this connection he discovered an available supply near Wadsworth, Nevada, this being a sand and gravel formation, clear of silt, and of a mixture in approximately the correct proportion for the concrete. Another source of supply was discovered in the Bear River near Colfax. Here the material was also in the form of gravel and sand in proportion very close to the desired mixture. Sand was also shipped from the Yuba River at Marysville. After having shipped many carloads from these sources it was determined that the Bear River sand could be handled and delivered not only cheaper, but in the desired daily quantity, which would not have been the case with the other sources. With the final adoption of the Bear River sand and gravel the quarry at the dam was virtually abandoned as it was found that the cost of getting the sand by drag-line buckets or steam shovel, loading into gondola cars, shipping to Lake Spaulding over the Nevada County Narrow Gauge and the Southern Pacific Railroads, and delivering directly into the bunkers at the dam, was cheaper than quarrying the rock, crushing it, and mixing with sand from other sources. The Lake Spaulding dam is therefore largely constructed of the quartz gravel and sand from the Bear River with but a small proportion of the Wadsworth gravel and of the native rock. In determining the condition of the concrete, a test house was erected close to the mixer house, and in this was placed a Riehle testing machine having a capacity of 50 tons, and other apparatus for testing boiling pats, and making tensile tests. Throughout the work samples of green concrete were taken from the dam after the concrete had been deposited, these samples being obtained at various points in the dam. Enough samples were taken every day to supply 3 for a 7 day test, 1 for a 28 day test, 1 for a 60 day, 1 for a 90 day, and 1 for a 5 year test. These samples were kept carefully indexed on shelves provided in the test house, and maintained in a moist condition by wet gunny sacks thrown over them. Each day the test samples, as their time became due, were broken, and very complete records were made on each to determine the condition of the mix, and to make any corrections necessary.

The proportion of the mix which has been generally used, and which was found satisfactory, was 1 part of cement, 2½ of sand, and 4½ of gravel. This is practically the proportion in which the sand and gravel is received. After very careful consideration it was found that while this was not the ideal mixture for greatest strength it was less costly and equally satisfactory to use a slightly greater amount of cement rather than sift the sand from the gravel and remix in absolutely correct proportions. The average time of mix given was 2 minutes. The average breaking strength per sq. in. was about as follows: 7 day specimens, 400 lb.; 28 day, 900 lb.; 60 day, 1000 lb. Ultimate strengths will of course exceed these amounts very much.

When the Spaulding dam was first proposed various consulting engineers made reports on the type of dam which would be necessary at this site. The site is so ideal for a high dam, and is, practically speaking, so narrow that the design of a curved dam immediately suggested itself, depending upon the curve altogether for the strength of the dam. Several of the early reports made on this dam were for a gravity type, including a curve upstream. These reports on this type of dam were made probably more as a matter of precedent than from expediency. The company, upon the commencement of work, had practically decided to adopt a dam of gravity section. After Mr. F. G. Baum came in charge of the work, in the fall of 1912, he proposed that the section be cut down, both as a matter of cost and from the fact that a curved section built upon the principle of the varying radius would offer all the safety factor which might be expected from a full gravity type dam. It was finally decided to begin the dam, using a gravity section for a height of 260 ft., which height it was proposed to build to during the year 1913. It was further proposed to continue this height to 305 ft., which would be the full height of the dam, and the continuation would be designed on the principle of the arch to resist the water pressure. Work was commenced on this plan in May, 1913, and the thickness of the dam was made 186 ft. at the bottom of the river. The upper face was made nearly vertical, while the lower face was stepped, the steps being 3 ft. high and 2 ft. wide, the radius adopted for the dam commencing at the bottom and extending up for 75 ft. was 250 ft. When the dam had reached a height above the foundation of 60 ft. it was decided on account of financial conditions not to attempt to carry the dam higher than 225 ft. during the present year. It was further decided that it would be possible to drop back the lower face so that the section as carried up from this point would be a pure arch. This section to be left so that the full height could be carried out by filling in the lower face and bringing the dam to 305 ft. In designing the ultimate dam, the stresses in compression adopted were all kept within 24 tons to the square foot, equivalent to 333 lb. per sq. in. as a maximum limit, gravity action not considered. In the lower 60 ft. the stress amounts to but 14 tons. This increases slightly until a height of 260 ft. is reached, when the stress becomes 23.9 tons, and this immediately falls off to zero at the top. The final designs were approved by Arthur P. Davis, Chief Engineer of the United States Reclamation Service. To prevent the collection of leakage water under pressure at any point in the dam there is a very complete system of vertical vent pipes. These are 8 in. wrought iron pipes, which run from the bottom to the top of the dam, the joints of which are not tight. There are four vertical transverse expansion joints from elevation, 75 ft. to the top. An inspection tunnel runs down on a slant from either end of the dam, and is joined by a horizontal tunnel near the bottom. Into this any leakage water will be carried. The waste outlet for the dam is just below this inspection tunnel, and contains a hand-operated 30 in. gate valve. The present height of the dam is 225 ft. The length of the crest is 580 ft., the amount of concrete which has been placed is 155,000 cu. yds., the variation of the radius from the elevation of 70 ft. above the foundation to the present crest is from

250 ft. to 400 ft. The upper face of the dam above the 75 ft. elevation has a batter of 1 in 6.

Outlet Tunnel.

The outlet tunnel has its intake at a point about 50 ft. back from the upstream face of the dam. This intake is covered with a heavy grating of flat steel bars set on edge, and is the end of a steel thimble or pipe which extends into the tunnel to a gate chamber. This intake pipe tapers from 10 ft. to 6 ft. at the gate. The gate has a cast steel butterfly valve, which is operated through a lever and gear mechanism by either a hand wheel or 7½ h.p. induction motor specially designed for the purpose. Access to this chamber is had through a tunnel which connects with the inspection tunnel into the dam, this tunnel being driven through the rock, and by means of a vertical shaft is brought above the dam to a gate house. There is an upper adit to the outlet tunnel. It is placed 100 ft. in elevation above the main intake, and is connected to the main tunnel by an incline shaft. The intake tunnel is lined with concrete for a distance of 1000 ft., the upper adit and shaft being likewise lined. This lining terminates in an upraise pipe into what is known as the Spaulding power house, which has been already briefly described. The remainder of this tunnel is not lined, and acts as a flow tunnel, as the water is not under pressure.

The Drum Canal.

The problem of design of this canal offered a number of rather complex situations. The country through which this canal passes is all side hill, some of it very rough, partly solid rock, partly broken, some of it is in earth which is more or less treacherous, and at all points it is subject to snowslides and other interferences which might be expected where a more or less severe winter climate exists. It was at first proposed to excavate a canal and to line it with reinforced concrete and with a reinforced concrete cover. After a careful study of the problem, in which the extra cost of concrete lining had to be considered, and also the time necessary for construction, it was decided for the present to build this canal as an open ditch, but at all points where there was danger of breakage or slides, or where the current of the flow might cause a wearing away of the canal berm, a rubble rock wall of very substantial proportions was constructed on the outer berm, while the inner berm was lined with a dry rock wall. As practically every place where it was necessary to build this masonry construction was a cut in rock or hard formation, the bottom of the canal is practically as solid as if it had been lined with concrete. The entire work of excavation of this canal was done by means of steam shovels—three 1½ yd. and one 2½ yd. shovels were used. The operation records of these shovels show that the larger shovel, which had a longer boom, was very much more efficient than the others. The average daily record of this shovel through the worst rock conditions was about 300 ft., while there were days when the shovel made over 500 ft.

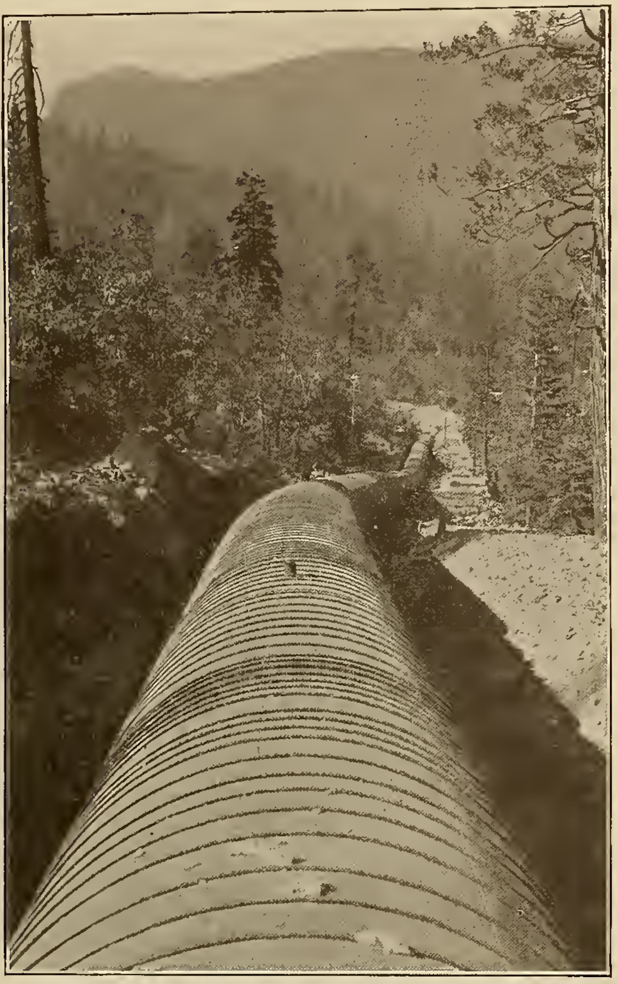
Just before entering the fore-bay of the Drum plant it was necessary to construct a siphon in order to cross a saddle in the ridge which supports the canal. This siphon is 8½ ft. in diameter, and is constructed of 5/16 in. riveted sheet steel. The length is 1888 ft., and the greatest static head of the siphon is 128 ft.

The Forebay Reservoir.

This reservoir, which is perched on the top or a knoll, is partially an excavation and partially a fill. The economic size of the reservoir was determined from a study of operating and plant conditions which applied on this system. It has a capacity of 399 acre ft., and is about one-half of the maximum size which could have been constructed at this point. It, however, represents about the lowest cost per acre ft. which would be possible here. In construction the work consisted entirely of plowing the ground, surfacing out the higher side of the hill, and transporting the loosened earth by Fresno scrapers which dumped through traps into wagons, and was distributed on the dam around the lower side of the reservoir, or was transported directly by wheel scrapers on to the dam. The greatest care was exercised in constructing the dam. The earth, of which the dam is made, is a gravelly clay of a red color, which overlies a hard cemented gravel. There was, to begin with, a layer of light yellow volcanic ash over the entire site which was not considered suitable as a material to put in the dam. This was all scraped off and discarded, amounting to about 75,000 cu. yd. The foundation of the dam was ploughed 2 ft. deep and tamped back. As the material was deposited it was wet thoroughly, harrowed, tamped with a petrolithic roller, and then with smooth rollers, forming a very compact mass. The greatest height of the dam is 54 ft. The inside slope is 3 to 1, the outer is 2 to 1 near the base and 1½ to 1 above; the width of the crest is 12 ft. From the inside edge of the crest down the slope for a distance of 50 ft. there is a paving of hand-placed rock. Below the line of this paving and across the entire bottom of the dam the earth was ploughed, puddled and tamped to make a water-tight and impervious lining. The canal enters at one end of this reservoir, and passes directly through to the point of intake of the pipe lines. There is a drop from the end of the canal, which follows the slope of the reservoir to the bottom, which is paved with rock. The continuation of the canal along the bottom of the reservoir is about 3 ft. deep and 35 ft. wide. The intake to the pipe lines is at the foot of the inner slope on the north side of the reservoir. It consists of a concrete enclosure, which is open on one side to the ingoing canal. The two openings into the pipe lines are formed of reinforced concrete, and have steel gratings to prevent the entrance of any detritus. These openings are 8 ft. in diameter, and taper to 6 ft., the diameter of the pipe which is brought into this taper so that the concrete surrounds the pipe, making a tight joint. The tunnel was built from the intake to the side hill, which forms the outer slope of the north side of the reservoir. This is a two compartment tunnel, part concrete and partly timber lined, and having a length of 328 ft. The pipe lines are laid side by side through this tunnel. On a level space, beyond the portal, is placed in each pipe line a 6 ft. butterfly valve, which is similar to the intake valve of the tunnel from Lake Spaulding.

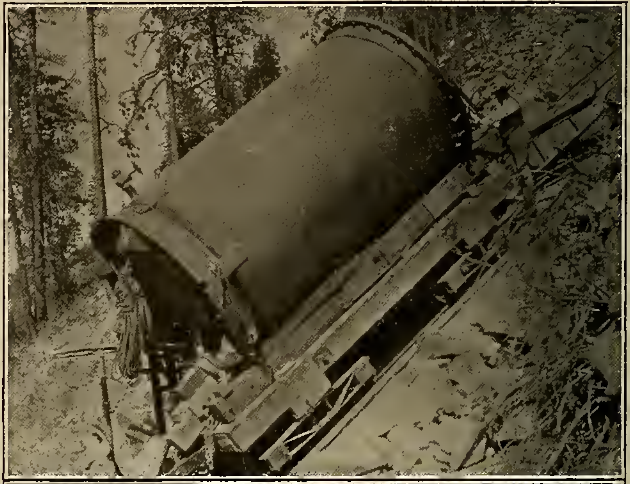
Pipe Lines.

For the present installation but one pipe line is in place. This has a length of 6194 ft. The diameter at the top is 72 in., and the thickness is ¼ in. This thickness increases with the head on the pipe



Siphon in the Spaulding-Drum Canal. This Was Necessary to Avoid Crossing a Corner of the Tahoe Forest Reserve. The National Forest Is Shown on the Left Side of the Pipe.

until at the power house the thickness is 1¼ in. The diameter for 4100 ft. remains at 72 in. It then is reduced to 66 in., then to 60 in., and finally enters the power house at 54 in. The material of the pipe is low carbon open hearth steel, and it is lap riveted to a point where the head is 262 ft., the straight seams being double riveted, and the round seams having a single line of rivets. Beyond this point the pipe is all butt and strap joint. In the heavier sections the straps are butt and strap-jointed, as in working with very heavy material it is impossible to lap over corners. Throughout the length of the pipe line it is laid in a trench, but in most cases is only half buried. There are some few instances where the pipe is entirely on the ground surface. The last third of the pipe has an average slope of about 40 degrees with the horizontal. There are in this section three anchorages. At a distance of 260 ft. back of the power house, in order that the pipe may enter the building horizontally, it is passed down through a concrete lined tunnel for a length of 256 ft. The pipe enters this tunnel on a slope of 32 degrees, and makes a turn to the horizontal before leaving the tunnel. The upper part of this tunnel, and also to a point below the turn, is back filled with concrete, and this forms the first anchorage. The only effective thrust on a pipe, except for the end thrust, will occur at sharp turns. In the steep section there are two turns, which include both horizontal and vertical angles. Near these turns are placed two anchors. These anchors are unique in design, and consist of a reinforced concrete ring 4 ft. wide, with a thickness of about 30 in., which is bonded to the pipe by three bands of angle steel 6x4 in., riveted to the pipe. These concrete rings, whose weight is supported on a foundation of their own, are held in place by sixteen 2 in. bolts with turnbuckles. These are equally divided into two groups on each side of the pipe, extend backwards along the line of pipe for 24½ ft., and are im-



Transporting an Allis-Chalmers 1250 k.v.a. Transformer Down the Tramway to the Drum Power House.

Looking Down the Pipe Line Toward the Drum Power House. A Pipe Anchor Is Shown in the Foreground Before the Pipe Had Been Laid.

bedded in a heavy block of reinforced concrete as an anchorage, this anchorage being placed on a horizontal shelf under the pipe, and cut well back into the hill. At a point about 4000 ft. along the pipe, which point is at the foot of an incline from the summit of the inverted siphon, is placed the fourth anchorage. This consists merely of a block of concrete under the pipe, to which the latter is anchored from both directions by ¾ in. x 10 in. steel straps riveted to the side of the pipe.

There are three expansion joints in the pipe. These are slip joints of a conventional type, which are packed with hemp. In a pipe of this length, even when filled with water, a variation in temperature may occur between the freezing point, or little above, say 35 deg., F., to probably 70 deg., F. The under half of the pipe being next the ground, is protected, but the total variation is due to the difference in temperature of the water between winter and summer. A rise in temperature of 35 degs. will make possible a total expansion of 13.8 in. in this pipe line. Much of this expansion may be taken up by distortion, which in reality would be very small, but in the heavier pipe might court disaster, consequently, to make doubly sure, the expansion joints have been provided.

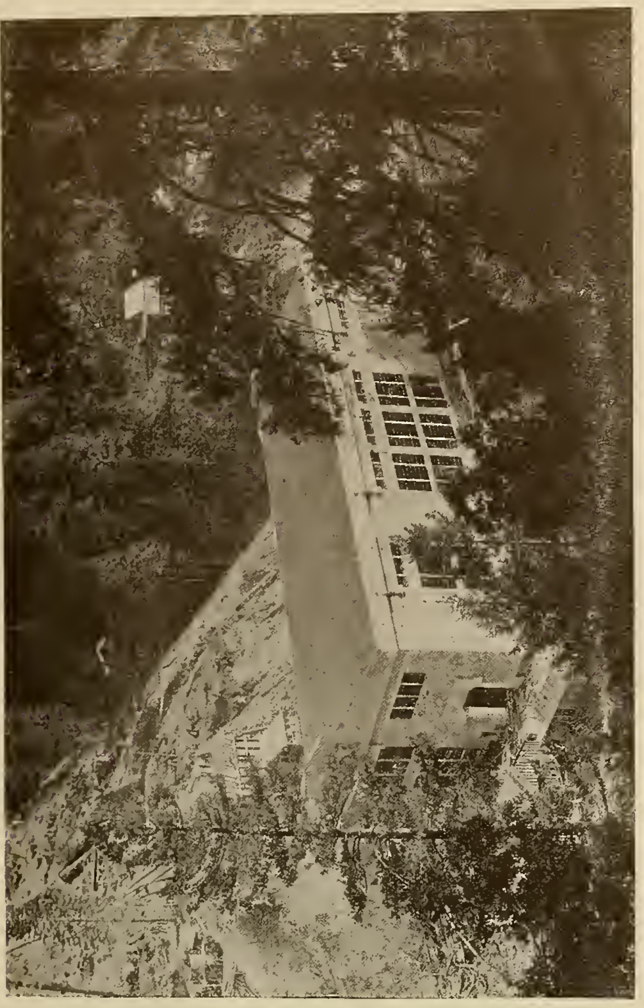
Relief valves are placed at three points on the pipe, the first set being at the outlet of the forebay tunnel, the next at the top of the inverted siphon, and the third set at the summit of the steep incline. The time of closing with a reservoir empty, which will still leave 25 ft. head on the inverted siphon, is designed for 30 seconds on the power house main gates, but the butterfly valve at the top of the pipe requires two minutes to close.

For the convenience of construction a railroad three miles long was built from the Southern Pacific at Orel, including three switch backs, to a point at the beginning of the inverted siphon which is in a saddle of the general ridge. Here also was located the warehouses and works camp. For the purpose of transportation of machinery and supplies to the power house a standard gauge track was built from the works camp parallel with the pipe line to the power house. This section is operated by cable and hoist, there being a 150 horsepower hoist located at the top of the inverted siphon which has a double drum with a cable working in both directions. A second hoist was placed at the head of the steep section of the pipe line, and the track down this section is known as the incline. A 1⅛ in. cable is used here to insure safe operation with heavy loads, which in some cases were over 40 tons. This incline is the spectacular feature at this point of the system.

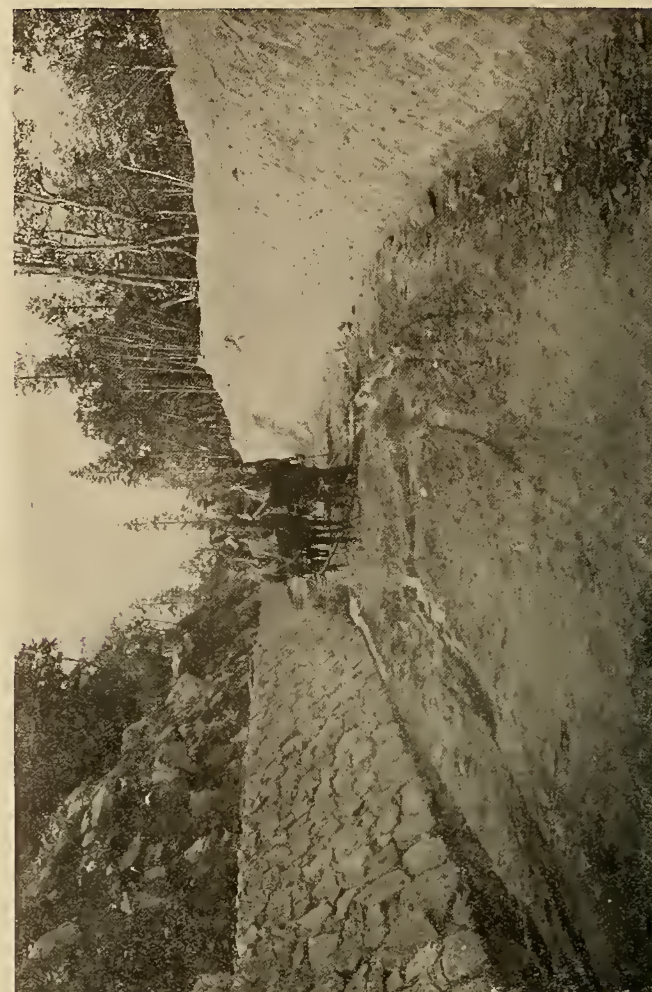
The Drum Pipe Line and Tramway Incline as Seen From the Roof of the Drum Power House.

Power House.

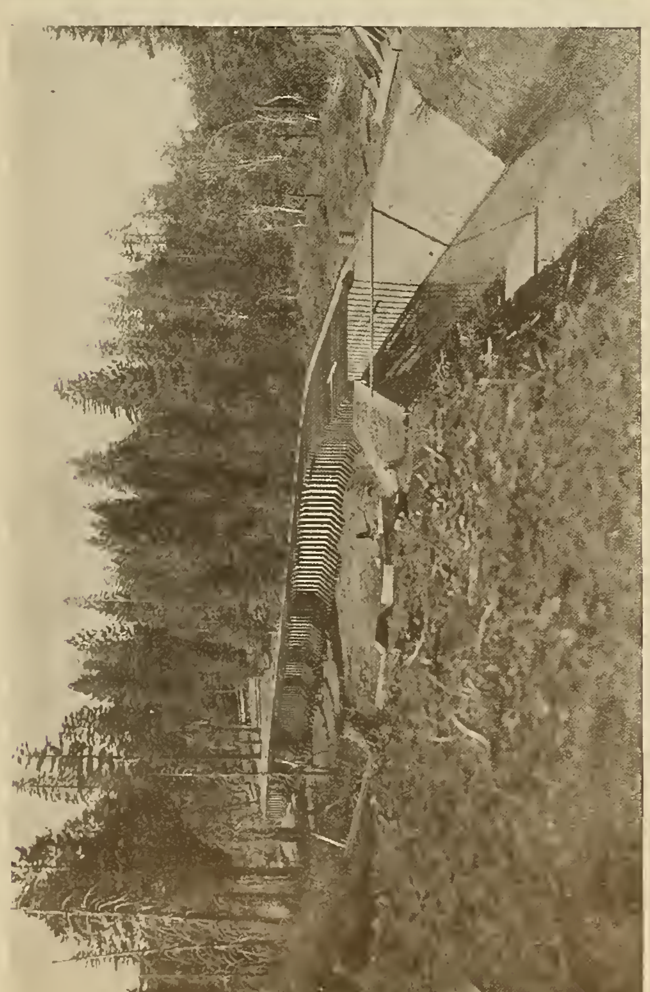
The power house is a steel frame structure designed to stand without the aid of supporting walls for a horizontal wind strain of 25 lb. per sq ft., and with a roof to carry a snow load of 30 lb. The building is rectangular, 209 ft. long and 78 ft. wide. The roof has an uneven hip with slight slope, and is 65 ft. above the floor. The floor line represents the bottom of the excavation which was made for the power house, the only cuts in this floor being those for the generator bodies and the tail races of the water wheels, and for the incoming pipe lines. The building in its design and general layout is typically representative of the best western high head practice. The main generators, of which there are to be four, are placed with their shafts on a center line lengthwise of the building and toward the front walls. The exciters are placed on two lines, which, however, rest between the two center generators, the exciters being right and left handed. Through the center of the building is a line of supporting columns, and between the front wall and this line of columns is formed the main bay or generator room. Between the generators and the center line of columns is a space sufficient for moving about and transporting machinery or parts from one end of the building to the other. The generators, furnished by the Westinghouse Electric and Manufacturing Company, are of the standard water wheel type, the armatures being mounted on cast iron bedplates, which are in turn mounted on the concrete foundation. The bearing standards are likewise supported. These have non-aligning bearings, self-oiling and water-cooled. The shaft is of nickel steel, is hollow, and extends beyond both bearings to carry the water wheel runners. The generator armature is 3-phase and star-connected for 6600 volts. The rotor is made up of three nickel steel discs placed side by side, about the periphery of which, are dovetailed the field coils. The armature and rotor are covered on either side by cast iron end-bells, which have outlets similar to those of a centrifugal blower. The movement of the rotor and the design of the field bobbin ends causes a strong flow of air, which is drawn from the tail races, and is forced through the armature windings and field laminations. These machines operate at 360 r.p.m. and have a rating of 12,500 k.v.a. The water wheels are housed in a cast iron casing, and are equipped with needle deflecting nozzles, which are operated by specially designed Lombard type governors. These have horizontal operating cylinders which exert a pull equivalent to 20,000 ft. lb.



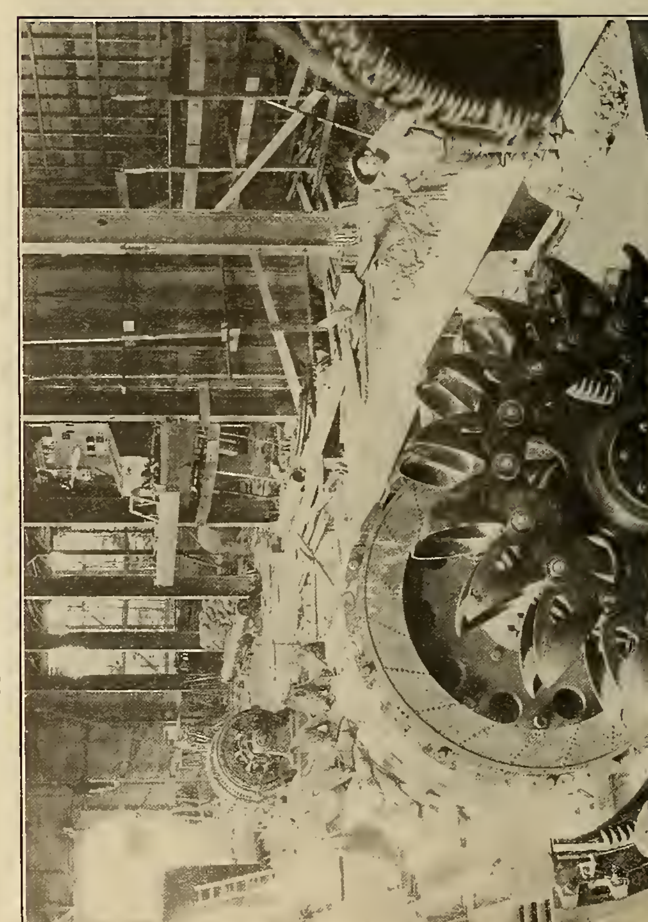
The Drum Power House.



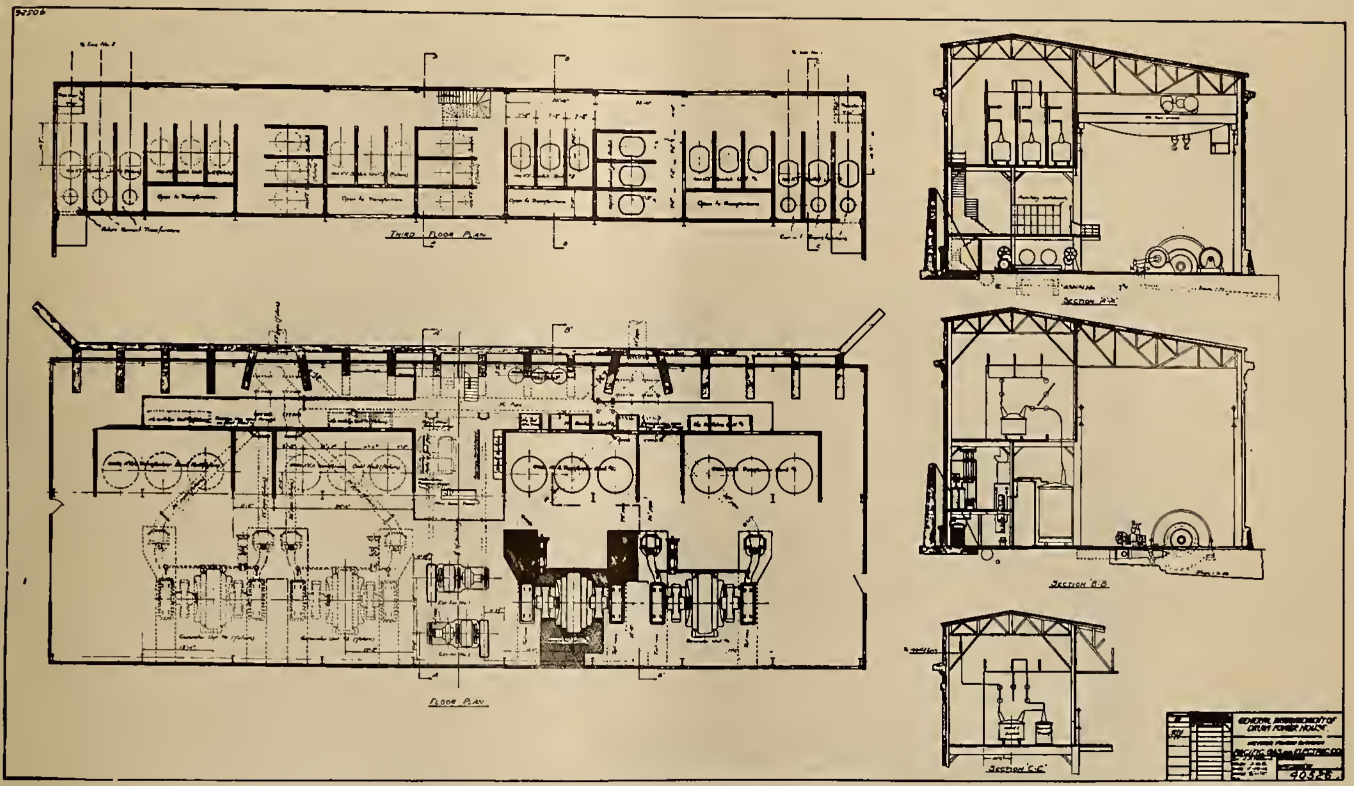
A Finished Section of Spaulding-Drum Canal, Showing Rubble Masonry Wall on One Side and Dry Rock Wall on the Other.



A Typical Flume on the Spaulding-Drum Canal Line.



Interior View During Construction of the Drum Power House, Showing Partially Erected 12,500 k.v.a. Generating Set, Exciter Unit and Switchboard.



Transverse Sections and Floor Plans of the Drum Power House.

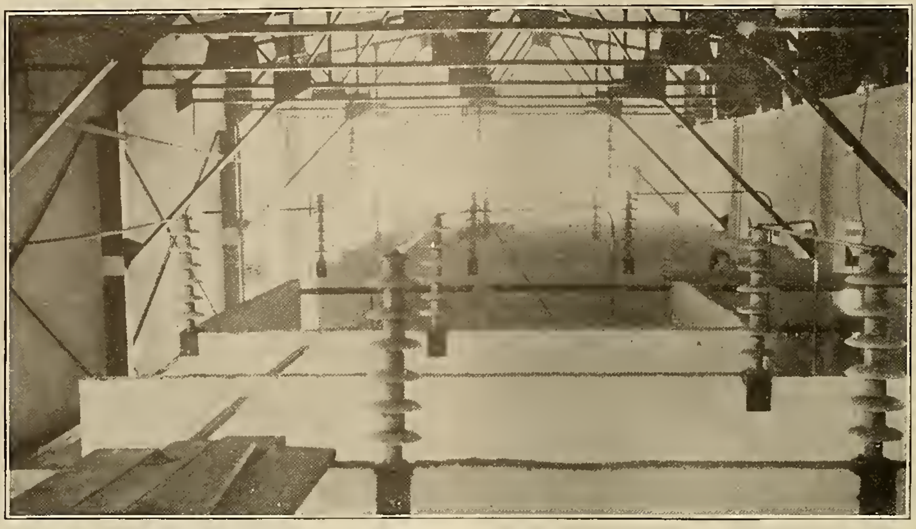
The main pipe line enters the rear of the building, and branches through a cast steel Y. To each leg of the Y casting there is bolted a 36 in. water wheel operated reversing gate valve. Bolted to each valve are secondary Y's and from each of these a sheet steel riveted pipe 26 in. in diameter is carried to each of the needle nozzles, all, excepting the valve bodies, being below the floor level. Bolted to an outlet in a cast steel section in the main pipe is a third 36 in. gate valve to serve as a connection for a third unit. The hydraulic machinery was supplied by the Pelton Water Wheel Company and is built upon the Doble patents. The switchboard occupies a space at the center of the building immediately in the rear of the center line of columns. Its floor is on a level of 10 ft. above the main floor. The switchboard consists of an operating remote control bench board facing the main operating room, and in the rear of this at right angles is the secondary board for the exciters and all auxiliaries. On either side of the switchboard place in six compartments are the transformers. There are in each compartment two oil-immersed, water-cooled transformers. These raise the generator voltage from 6600 to 72,000, which is eventually star-connected to give 125,000 volts for transmission. There are taps in the high-tension winding for 120,000, 115,000 and 110,000 volts. The transforming equipment was supplied by the Allis-Chalmers Company. In the rear of the transformers on a gallery at the same level with the switchboard are placed the 6600 volt generator, transformer and bus switches, and switch cells. These switches are all of the remote-control, solenoid-operated, oil-immersed type.

The high tension gallery occupies a floor over the transformers and low tension switches. The barrier system of separation into cells has been strictly adhered to in the design of this part of the power house. All high tension lines, switches and bus lines are protected by 6 in. thick concrete walls. The high tension switches installed in this plant are of a design which has been developed in the service of the company, and are in general use on the company's lines. These circuit breakers consist of cast iron tubs 4 ft. in diameter, supported on a light structural steel frame, mounted on insulators. The switch mechanism has two horizontal arms with a break at each end, making four breaks in all. These breaks are made horizontally, and the arms are supported at the lower end of a vertical operating shaft. Two of the switch jaws are mounted at the lower end of the cover insulators. The other two are connected across inside in such a manner that the four breaks are made in series. The insulators and switch mechanism is all supported from the cover of the tank, which is made of cast aluminum. The switch tanks are filled with mineral seal oil. The high tension lines leave the building through large openings in which are placed two panes of plate glass; the inner of these has a hole 12 in. in diameter, and the outer 18 in. in diameter, through which the conductor is passed. The outgoing lines leave the rear of the power house, being carried to towers, and from these are spanned over the power house, and across the canyon to the first tower of the transmission line.

Transmission Line.

The transmission line has a length of 109.5 miles from the Drum power house to the Cordelia substation. It is throughout supported on steel towers. There are two general types of towers used on this line. The standard tower has a height of 82 ft. to the topmost point, and carries three arms, which support the transmission conductors from each end of

the arms. The circuits are therefore in a vertical plane. There are three weights of standard towers designed for different classes of service. The first and lightest weighs 4600 lb., and is designed for use on tangents and angles of not over 5 deg. It is tested to a horizontal strain at the center point of the middle arm of 18,000 lb., which is the condition in case any two of the transmission conductors should break. The second class, or "B" towers are designed to stand a strain of two broken wires, and spans up to 1500 ft. They weigh 5300 lb. The third, or type "C" tower, is designed to stand a dead-end strain, the longest spans and also for angles of any degree. The weight of these towers is 7200 lb. There are about a dozen cases where additions and changes have been made to standard towers for the purpose of getting extra high towers for crossing railroads, rivers and other transmission lines. The second type of tower employed is known as the "snow tower." These carry a single circuit, and consist of a pair of A frames, across the top of which are horizontal channel beams. These beams extend outside of the A frames, and support the two outside wires of the transmission. The third wire is hung from the center of the structure. These towers are designed to carry a dead-end strain, and any angle or snow strain which may be brought to bear upon them. It is proposed, in order to carry two circuits, to install two lines of snow towers, and the foundations of the second line are now in place. The weight of these towers is 4050 lb.



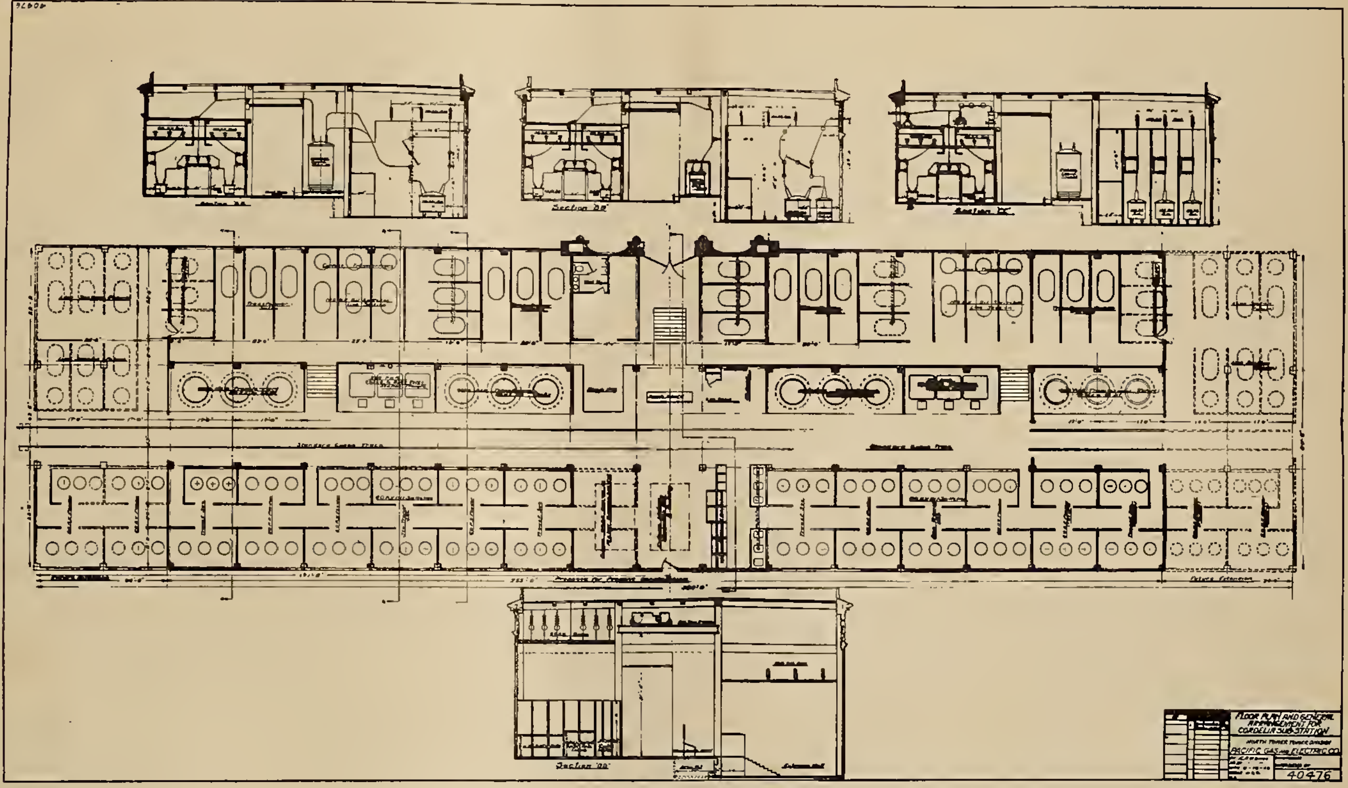
High Tension Line Connections and Outlets in Drum Power House.

Throughout the transmission the footings of all towers are imbedded in concrete. These concrete bases were all set before the towers were erected, a simple pipe template being used to get the proper position. There is about one yard of concrete to each footing, making an average of 4 yd. for the tower. For extra high towers special concrete bases have been provided.

The standard towers are designed to carry two circuits of No. 4/0 copper conductor. The spacing of the towers averages about 512 ft. in the mountain section where the snow towers are used, and 800 ft. in the valley section on tangents. There are 731 towers altogether. In the mountain section there are several very interesting spans over deep canyons. The longest of these spans is 4220 ft. In two of these a spreader is used at the bottom. This spreader being merely one of the standard snow towers with a 40 ft. arm, to which the conductor is fastened, but which does not carry weight. In another case the line is supported and prevented from swinging by a steel cable strung transversely across the canyon, and from which are suspended insulators which hold the transmission wires. In the actual construction of this line but one circuit has been installed. It was found that

"Snow" Tower on Drum-Cordelia Transmission.

with the present installation of two machines at the Drum power house, and with the present condition of the power market, it would not be necessary to have more than one circuit of 3/0 copper or its equiva-



Plan and Transverse Sections of the Cordelia Substation.

lent. By using a conductor of this size, which could later be used elsewhere on the system, it was possible to make a considerable saving in this case, and this was therefore done. About one-half of the conductor is 5/0 aluminum, which is the equivalent of 3/0 copper. The long spans are 40 per cent conductivity, copper-clad wire. There is neither a ground wire or a telephone line on these towers, as the practice of this company is against these adjuncts. The insulators on this line are all the suspension type, furnished by the Ohio Brass Company, there being six sections to each insulator. At road and railroad crossings and at dead ends two strings of insulators are used at each point of support. In the first case this is in compliance with the California law, which is vague in its construction and unreasonably severe.

Cordelia Substation.

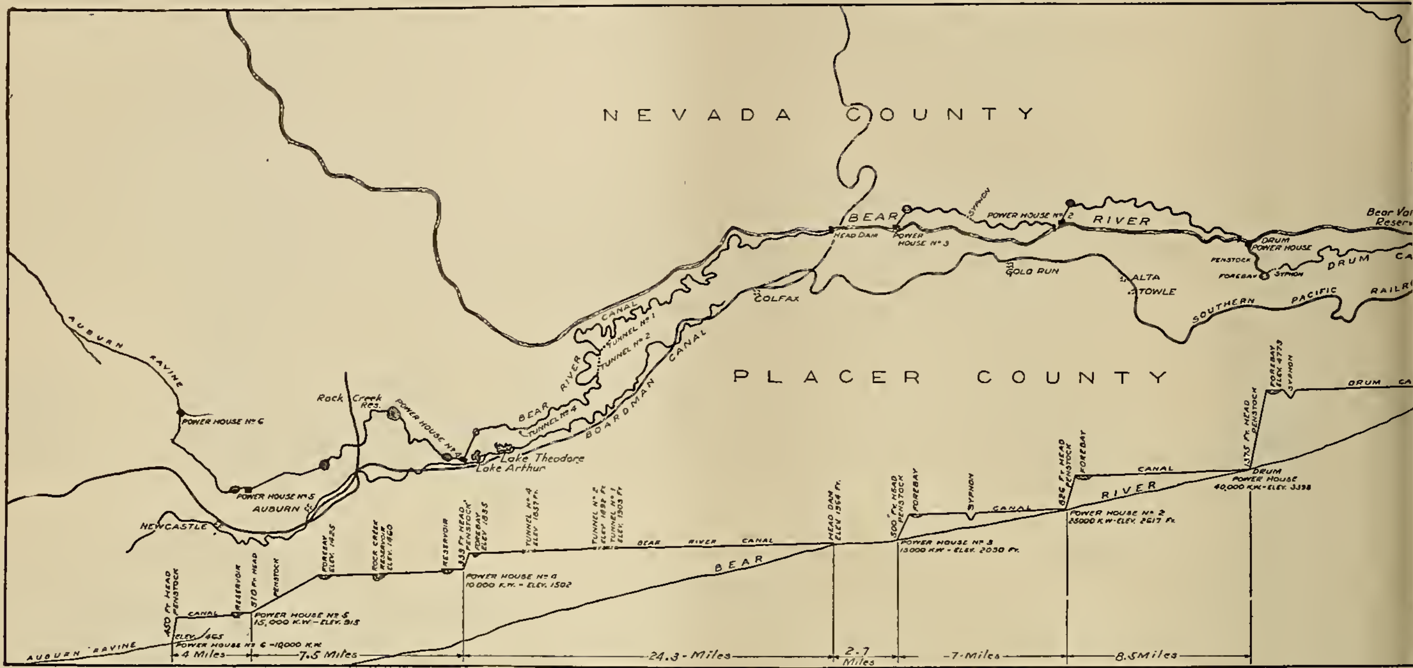
The substation at Cordelia represents practically the center of distribution of the network. After a very careful study of the situation with the possibilities of future enlargement and expansion, it was decided to make this the point of 60,000 volt distribution, practically in all directions. It therefore becomes a logical point for the end of the 100,000 volt supply of the new system. The actual center of distribution of the system is now within the Straits of Carquinez; that is, there are times when the direction of power flow is one way, and other times when it reverses. The natural trend of growth in the supply of power will be in some direction toward the source of supply. As there are several points of supply widely separated, this locus will for the present assume a segment of a circle. As the demand for power increases and the proportion of power from this system becomes greater in reference to the other power plants, this locus will shorten to a point. The determination of this point is necessarily a very complex subject in power plant economics, and has required an intimate knowledge of past and present operating conditions, past, present and future probability of the power market, as well as effects of political and municipal control. This has only been available to those who have been in closest touch with this system.

This substation is a reinforced concrete building 256 ft. long, 82 ft. wide, 43 ft. high. Architecturally it follows the Spanish Mission style of powerhouses, and is very beautifully finished. This building contains the transformers, of which there are two sets of three, 4000 k.v.a in each, for reducing the voltage of the Drum transmission of 100,000 to 60,000. These transformers are in reality balancing coils, there being but one winding in which the 60,000 volt connection is made by a 6/10 tap. In other respects the coils are similar in appearance and in operation to the transformers at the power station, except in size and weight, in which they are much smaller. The front half of the substation is devoted to the switch cells, switches and bus lines of the 100,000 volt circuits. The rear half, separated by longitudinal passageways, is devoted for a similar purpose to the 60,000 volt circuits. The switchboard is mounted at the center of the building, and controls all circuits, incoming and outgoing. This substation, like the high tension section of the powerhouse, follows the plan of complete barrier protection for all high tension lines, and is thus an intricate network of concrete walls to form the cell barriers.

Economics of Design.

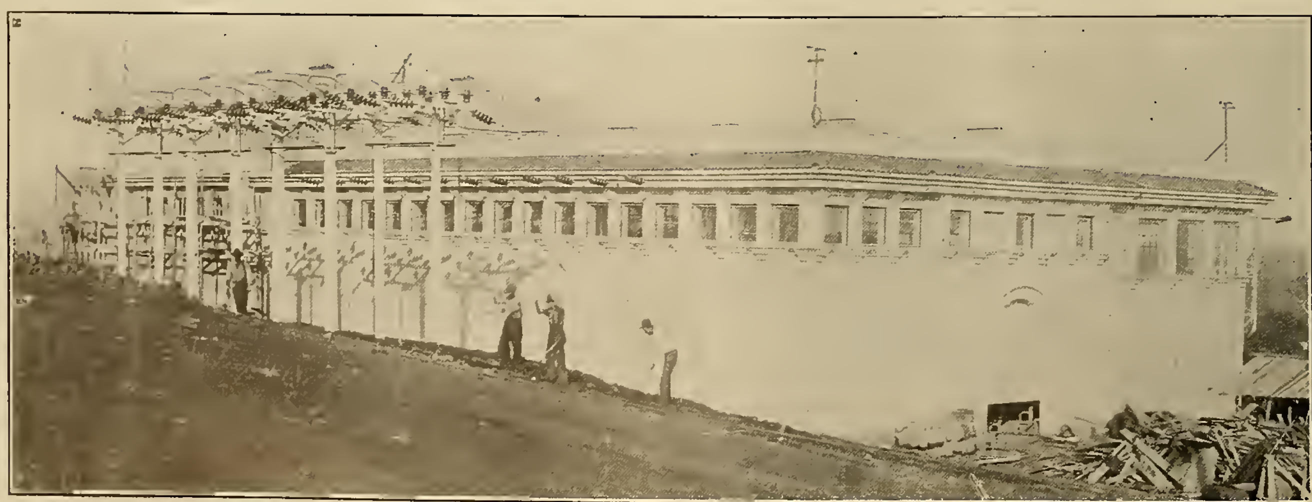
Every part of this development is dependent on every other part in forming a properly balanced whole. The power conditions for service of the Drum

plant depends largely upon the service possibilities of the other plants in the system. The capacity of the Drum plant, whose full load capacity is considerably in excess of the maximum average of the water flow, determined the position of the forebay, and hence of the pipe line. There were two points from which to choose a forebay reservoir, and three courses for a pipe line. The determination of the forebay reservoir, its economic capacity, hence its duty, made possible a close determination of the economic route of the pressure pipe. These points have been very carefully balanced in this plant, rather more so than is, unfortunately, the case in many modern installations. The location of the level of the forebay reservoir fixed the location of the canal and the grade, and hence the section of the canal would fix to a certain degree the point of outlet from the dam. This point of outlet in turn determined to a certain extent the height of the dam, and hence the storage possibility. The available storage possibility is, of course, determined by the duty of the watershed, but the storage availability which might have been economically advisable might be quite different from the result possible from the watershed. These values must be studied with reference to their effect upon the powerhouse design, and its effect in turn upon the remainder of the system installed, giving consideration to the cost and value of steam generated power during periods of low water in other parts of the system. It is not possible in this paper to go into the economics of the design of this plant to any greater extent than is given here, but it is hoped that enough has been given to at least start a discussion and bring out the points of greatest interest and value to the members of the institute.



Map and Profile of the Complete Lake Spaulding Power Development

The first two units (25,000 kw.) of the Drum plant were put in operation on November 26, 1913. It is interesting to note that not only have the estimates of time and cost been realized, but that the entire system has been put into operation without a single electrical or mechanical weakness developing. This means not only careful designing and construc-

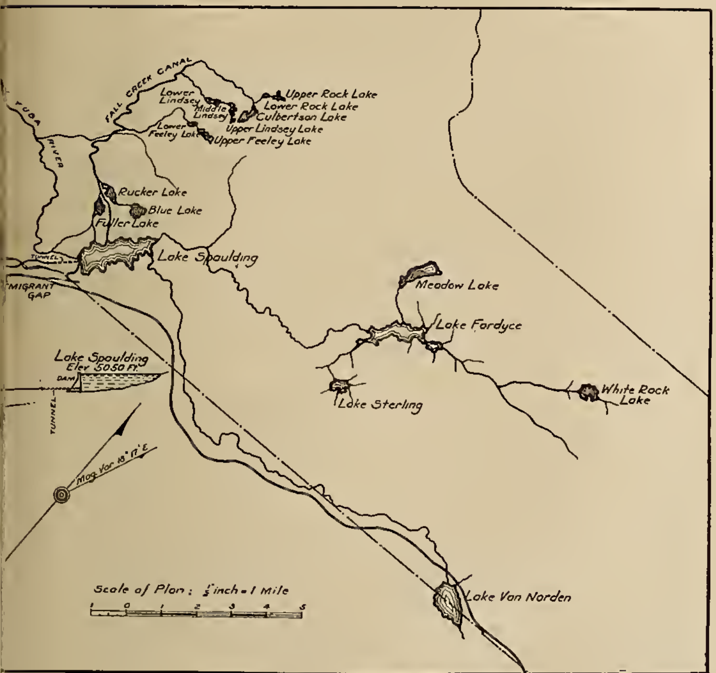


The High Tension Distribution Point and Substation at Cordelia.

tion, but is also very complimentary to all manufacturers who furnished apparatus and materials for the development.

The officers of the company are F. G. Drum, president; J. A. Britton, vice-president and general manager; A. F. Hockenbeamer, vice-president and comptroller.

The work was designed and constructed under the direction of F. G. Baum, chief engineer and general superintendent, with P. M. Downing as assistant;



H. C. Vensano, civil engineer; J. P. Jollyman, electrical engineer. D. H. Duncanson and W. H. Harrelson had charge of the dam and tunnel construction, O. W. Peterson was assistant superintendent of the canal, forebay and pipe construction, and E. H. Steele was superintendent of transmission line.

Gasoline produced from natural gas in the United States last year totaled 12,081,179 gallons (derived from 4,687,796,329 cu. ft. of gas), an increase of 4,655,340 gallons over 1911.

Road making is as old as civilization, but the application of electric power for this purpose is comparatively new. The Managers' Bulletin issued by the Pacific Power & Light Company gives a description of road-making activities in Umatilla county. A macadam road from Pendleton to the Washington line, forty-five miles in extent, is being built. One cut alone necessitated the removal of 20,000 cu. ft. of rock and this is crushed and screened by electric power and used in building the road. There are two crushers each turning out 75 yds. of rock per day, which builds 200 ft. of road at $1.50 per day for power. A portable substation transforming the 23,000 volt current to 2300 for the motor was installed in order to reduce the cost of hauling the crushed rock. The installation is described by F. W. Vincent.

HORSE POWER TRANSMITTED BY BELTS.

BY R. GUILLON.

(Under the caption "Practical Mechanics" was published in this journal for March 19, 1910, a diagram worked out by Prof. J. J. Flather, for finding the horsepower transmitted by belting. Since that time Prof. J. N. Le Conte has discovered an error in Flather's assumptions which materially alters the final formula. A new diagram is therefore published herewith based upon the corrected formula and is abstracted from an article published in The California Journal of Technology, University of California, November, 1913.—The Editors.)

The maximum belt tensions recommended by different authorities vary considerably and are usually given without any definite statements as to thickness of belt and method of fastening. However, of the half-dozen values quoted in Kent's Pocket Book all, when reduced to parallel conditions, lie within ten per cent of those used in the construction of this diagram.

The figures used for weight of the belt correspond to a density of from 55 to 70 pounds per cu. ft. Kent gives 56 as an average figures, but quotes a rule by Webber which would require a density ot 75 lb. per cu. ft. The coefficient of friction varies greatly, but is taken usually as between 0.3 and 0.4, and seldom less than 0.25. These curves may be considered as allowing a safe margin in this respect.

In this diagram (Fig. 1) Curves A show horsepower transmitted per inch of width with large pulleys and 180 degrees angle of contact for given velocities of belt and types of belting shown.

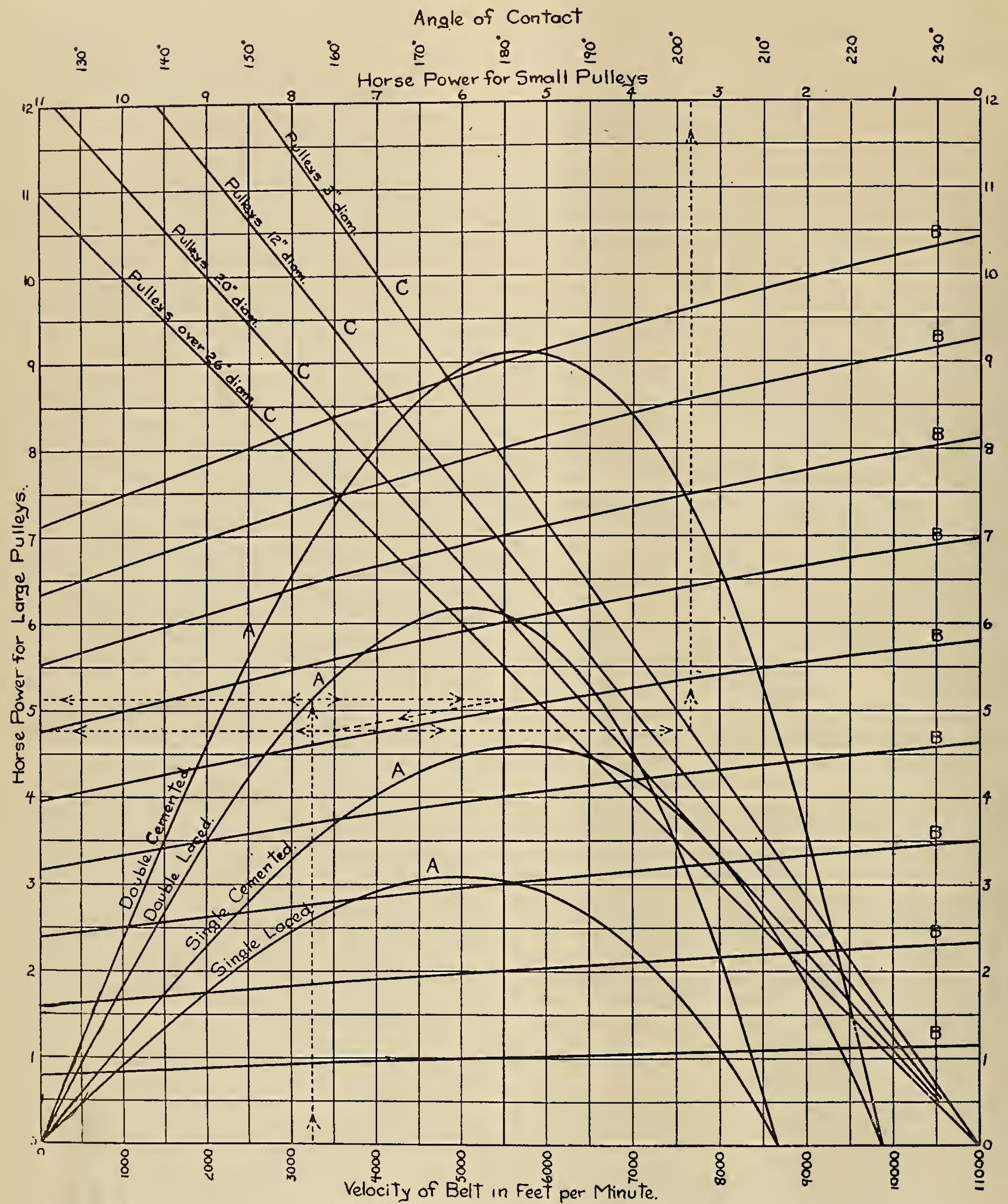
Curves B show horsepowers at varying angles of contact for given horsepowers with 180 degrees contact.

Curves C show horsepowers transmitted by small pulleys under conditions corresponding to given horsepowers for large pulleys.

The curves (A) for the four types of belting at varying degrees are plotted using 180 degrees as the angle of contact of belt on pulley. Each of the horizontal logarithmic curves (B) is plotted for varying values of the angle of contact, all other factors remaining constant. In drawing the lines for small pulleys (C) it is assumed that the ratio of the power transmitted by small pulleys to that transmitted by large pulleys for the same conditions of velocity and angle of contact is a constant depending only on the pulley diameters. The position of these lines was determined experimentally.

To use the diagrams, suppose we have a double laced belt running 3,250 ft. per min. with 160 degrees angle of contact on a three-inch pulley; to find the allowable horsepower per inch of width.

Following up the 3,250 ft. per min. ordinate to curve A for double laced belts, we find 5.13 as the power which would be transmitted per inch of width if the angle of contact were 180 degrees and the pulley large. To reduce this value to the given conditions, start from 5.13 on the 180 degrees ordinate and follow parallel to curves B to the 160 degrees ordinate. This gives 4.77 as the power transmitted with 160 degrees contact, but with a large pulley as before. To find the reduction due to the use of the small pulley, start from 4.77 on the scale for large pulleys, follow horizontally to line C for three-inch pulleys, and then up to the scale for small pulleys, reading 3.35 as the horsepower per inch of width under the conditions as given.



HORSE POWER TRANSMITTED BY LEATHER BELTS PER INCH OF WIDTH.

Fig. 1.

While giving results with a greater degree of accuracy than is demanded in practice, these curves furnish a simple and quick method of finding the power which a belt will transmit, taking into consideration all of the fixed conditions of operation. They are in this respect superior to most belt formulae and tables, which as a rule neglect factors which under some conditions are apt to prove important.

Nitrogen-filled lamps for street lighting purposes are being installed at Springfield, Ill., which is said to be the first city using this new lamp for that purpose.

The mineral wealth of California produced in 1912, according to Edw. W. Parker of the U. S. Geological Survey was $92,837,374, an increase of $2,216,730 over 1911.

PUBLIC UTILITY ACCOUNTING IN OREGON.

This series of articles deals with uniform classification of accounts for Electric Utilities, Gas Utilities and Water Utilities, prepared under the provisions of the State of Oregon Public Utility Act (Chapter 279 of the Laws of 1911) and prescribed by the Railroad Commission of that state.

All accounts kept by any utility within the scope of the act must be kept by the double entry method. This requirement however, is not intended to apply to purely statistical accounts.

The first entry relating to anything for which a charge or credit is made to any fixed capital or investment account must describe the property in respect of which entry is made with such fullness and particularity as to enable its identification.

For the purpose of this system of accounts Utilities are divided into three classes as follows:

Class A. Utilities having gross annual operating revenues exceeding $100.000;

Class B. Utilities having gross annual operating revenues exceeding $25,000, but not more than $100,000;

Class C. Utilities having gross annual operating revenues of $25,000 or less.

Any utility desiring a more detailed classification than that prescribed may go into as much subdivision and refinement of each of the accounts as its interests requires, provided that such subdivision does not impair the integrity of the accounts as required by the act.

Instructions Pertaining to Uniform System of Accounts for Electric, Gas, and Water Utilities.

1. **Balance Sheet Accounts Defined.**—By "balance sheet accounts" are meant those titles (listed under the headings, "Asset Accounts," and "Liability Accounts") under which the ledger accounts are combined and summarized to show the assets, liabilities, and deficit or surplus of the business at a given time. Where the title and definition of a balance sheet account clearly indicates that it is a summary of other accounts it is not required that a special ledger account shall be raised under such a title to include the balance from the accounts usually carried on the ledger.

2. **Cost or Book Value of Securities Owned.**—The term "Cost or Book Value" as applied to various accounts representing securities owned, is intended to recognize the option of the utility of carrying its investments in securities either at cost or at a reasonable valuation other than cost. Whenever securities are acquired, they are to be entered on the book at cost. If, subsequently, the utility desires to adjust their valuation on account of substantial appreciation or depreciation, the entries in its books with respect to such securities, as well as its annual reports to the commission should clearly show the reason for making the adjustment.

3. **Re-Acquired Securities.**—The Liability Accounts for capital stock and funded debt in the balance sheet are intended to include only the par value of such capital stock or funded debt securities as have been actually issued to bona fide holders for value or such securities as have been issued by other companies and have been assumed by the accounting utility and are outstanding at the date of the Balance Sheet statement.

When Capital Stock or Funded Debt Securities have been actually issued to bona fide holders for value (or after such issue by another company have been assumed by the Accounting Utility) and after such issues (or assumption) have been re-acquired by the utility under circumstances which require that they shall not be treated as paid or retired, they may be charged at par value to the appropriate Asset Account, but on the balance sheet statement they should be shown separately as a deduction from both the Assets and Liability Account in order that the Asset Accounts for securities owned will include only securities of other companies and that the Liability Accounts for securities issued or assumed will include only those in the hands of the public.

If any such securities are re-acquired for more or less than their par value, the difference between the par value and the cost of re-acquirement, after adjusting any amounts carried in the discount and premium accounts or other accounts with respect to such securities, should be debited or credited to Corporate Surplus of Deficit Account. Unless re-acquired for a sinking or other fund, which is required to be represented by a reserve, in which case the difference should be debited or credited to account, "Surplus Invested in Sinking Fund" or to account "Other Surplus Reserved" as may be appropriate.

4. **Discount and Premium on Capital Stock.**—Ledger Accounts should be provided to cover the discount and premiums on each class of capital stock issued or assumed by the utility. By "Discount" is meant excess of the par value of stock issued or assumed over the actual money value of the consideration received for such stock (except stock that has been sold and re-acquired); by "Premium" is meant the excess of the actual money value of the consideration received for stocks issued or assumed over the par value of such stock (except stock that has been sold and re-acquired).

Entries in these accounts representing discounts should be carried therein until offset: (1) by premiums realized on subsequent sales of the same class of stock; (2) by assessments levied on stock holders; (3) by appropriation of surplus for that purpose; or (4) by charges to corporate surplus or deficit account upon re-acquirement or retirement of stock. Entries in these accounts representing premiums realized, should be carried permanently, until offset: (1) By discount suffered on sales of the same class of stock; or (2) by credit to corporate surplus or deficit account upon re-acquirement or retirement of stock. If the net of the balances in the discount and premium account for all classes of capital stock sold or exchanged is a debit balance the amount should be included in the balance sheet statement in account, "Unextinguished Discount on Capital Stock"; if a credit balance, the amount should be shown in account, "Premium on Capital Stock."

In no case should discount on capital stock be charged to or included in any account as a part of the cost of acquiring any property, tangible or intangible, or as a part of the cost of operation.

[To be continued.]

JOBBERS AT DEL MONTE.

Once again the Pacific Coast electrical jobbers and manufacturers have met in quarterly session "to chase the spheroid over the long green and also to be separated from some of the long green," to misquote a Wigginism. December 4, 5 and 6 at Del Monte gave full answer to the poet's query as to "What is so rare as a day in June?"

Golf was, of course, the all-absorbing subject. While the scores show that these electrical men can hit the ball, their pictures will raise the question "Is it form?" Whether caught in the act of a preliminary waggle, foozling, slicing, pulling or topping, none but a captious critic would deny that they showed great ability in addressing the ball, either orally or physically. Even the caddies, laden with driver, brassey, cleek, mashie, niblick and putter, confessed that they had never heard (of) such capable addressing.

The fascination of this game almost baffles description. Those who come to scoff at the game of golf soon their coats will doff and after the pill they're off.

Even "Kid" Murray now has more clubs than the law allows in any poker deck. He has not only cashed in his former enormous winnings at the latter game so as to buy golfers' paraphernalia, but also goes to bed at 10 o'clock so as not to spoil his golf. Whereas he was consoled with the high gross score at Gearhart, he was awarded the manufacturers' cup at Del Monte.

"Porch-climber" Wiggin, the inveterate fun-maker and veteran card sharp, also broke into the second story and came out on the roof with the contractor's cup. Benny Herr likewise foiled his opponents by winning a (tin) foiled cup. Colonel Carter will hold the Patton cup for low net score during the next three months, although most of the other honors were carried off by Fred Leggett, whose four cups show his prowess in calling "fore" on the fairway; these included not only the regular jobbers', Every Ready and Del Monte cups, but also a special cup given by the Hotel Del Monte for low gross score. The first two he will hold until the next meeting, while the others will be subject to the tax collector.

The following tabulations show the detailed results

Jobbers' and Del Monte Cup.

	Gross.	Handi-cap.	Net.	Handi-cap.	Net.
Berry	104	+13	117	0	104
Burger	115	— 1	114	0	115
Brainard	95	+ 7	102	+7	102
Carter, H. V.	97	+ 6	103	0	**97**
Carter, C. H.	107	+ 2	109	0	107
Elliott	116	— 6	110	—6	110
Goodwin	109	+13	124	9	109
Graham	127	—12	115	—12	115
Hillis	101	+ 8	109	+ 5	106
Hall, C. B.	114	— 8	106	—10	104
Hartley	115	—16	129	—16	129
Leggett	**99**	0	**99**	0	**99**
Killam	134	—16	118	—16	118
Wiggin	**161**	—48	113	—60	101

Ever Ready, Contractors' and Del Monte Cups.

	Gross.	Handicap.	Net.
Berry	110	Scratch	110
Burger	111	Scratch	111
Brainard	101	+ 7	108
Carter, H. V.	101	+ 7	108
Carter, C. H.	111	Scratch	111
Elliott	133	— 6	127
Goodwin	109	Scratch	109
Graham	...	—12	...
Hillis	105	+ 7	112
Hall, C. B.	121	—15	106
Hartley	No returns	—16	...
Leggett	96	Scratch	**96**
Killam	137	—16	127

Manufacturers' Cup.

	Gross.	Handicap.	Net.
Barlow	125	—13	112
Bibbins	104	+ 4	108
Collins	142	—18	124
Gregory	102	— 1	101
Herr	**153**	—18	135
Hall, H. B.	120	—13	107
Hyde	121	—15	106
Lillard	97	+15	112
Morris	132	0	132
Murray	118	—24	**94**
Oakes	112	—10	102
Poss	125	— 8	117
Sanderson	96	+15	111
Seaver	125	—18	107
Squires	126	—18	108
Steele	125	—24	101
Vandegrift	152	—24	128
Young	125	+ 8	132

Other outdoor sports, such as tennis, swimming and tramping, occupied the other daylight hours, while a host of ordinary and extraordinary indoor sports accounted for the Mazda-light hours. Of the latter the only results which we are allowed to publish are those of the pool tournament, which was won by Harry Byrne, with John Cole second.

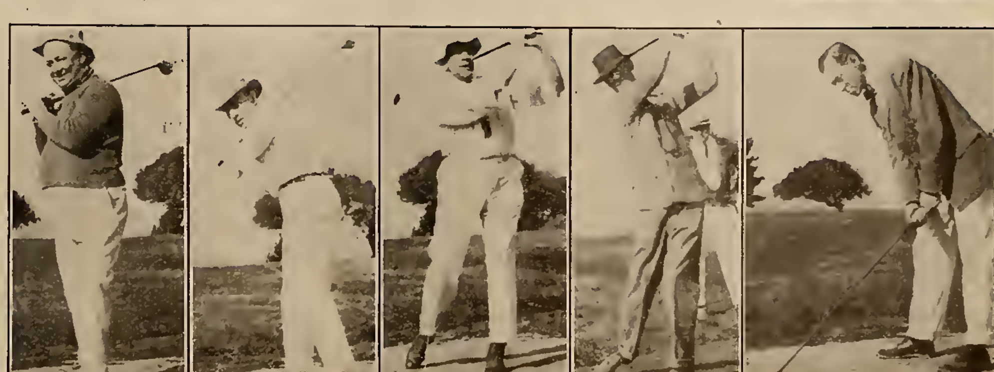
Saturday afternoon great enthusiasm was developed with regard to the Society for Electrical Development and on the understanding that a Pacific Coast office be established, every jobber present stated that his firm would give favorable consideration to joining this co-operative movement.

While these few business details were being settled, the ladies in the party played bridge, motored, rested and wandered around through the beautiful and historic surroundings with which this spot is blessed.

The regular golf dinner was held on Saturday night, and, as usual, was the occasion of much good-natured fun. C. C. Hillis presided as toastmaster and first saw to it that the individual who had W. B. Hall's goat returned it to him. The several cup-winners were called upon to tell how they did it, and W. L. Goodwin announced that arrangements had been perfected to the annual convention of the national association at Del Monte in 1915. Speeches were also made by H. V. Carter, A. H. Halloran and A. H. Elliott.

The following were in attendance:

Mr. and Mrs. C. H. Carter, Pacific States Electric Co., L. A.
Mr. and Mrs. C. C. Hillis, Electric Appliance Co., S. F.
Mr. and Mrs. F. H. Leggett, Western Electric Co., S. F.
Mr. and Mrs. H. V. Squires, H. V. Squires Co., San Francisco.
F. N. Averill, Fobes Supply Co., Portland. Ore.
A. E. Barlow, American Ever Ready Co., San Francisco.
W. S. Berry, Western Electric Co., San Francisco.
T. E. Bibbins, General Electric Co., San Francisco.
T. E. Blake, Hawaiian Electric Co., Honolulu, T. H.
H. B. Brainard, Western Electric Co., San Francisco.
T. E. Burger, Western Electric Co., Los Angeles.
Harry Byrne, North Coast Supply Co.. Seattle, Wash.
H. V. Carter, Pacific States Electric Co., San Francisco.
Jno. R. Cole, John R. Cole Co., San Francisco.
T. E. Collins, Westinghouse Electric & Mfg. Co., S. F.
A. H. Elliott, Secretary, San Francisco.
W. L. Goodwin, Pacific States Electric Co., San Francisco.
M. W. Graham, Holabird-Reynolds Co., Los Angeles.
J. A. Greer, Rail Joint Co., New York.
S. B. Gregory, Arrow Electric Co., San Francisco.
C. B. Hall, Illinois Electric Co., Los Angeles.
W. B. Hall, Pass & Seymour, Inc., San Francisco.
A. H. Halloran, Journal of Electricity, Power & Gas, S. F.
Ross Hartley, Pacific States Electric Co., Los Angeles.
Jos. A. Herr, Sprague Electric Co., San Francisco.
R. D. Holabird, Holabird-Reynolds Co.. San Francisco.
P. B. Hyde, Thos A. Edison, Inc., San Francisco.
F. N. Killam, Pacific States Electric Co., Seattle, Wash.
O. W. Lillard, Gould Storage Battery Co., San Francisco.
Jno. M. Morris, Westinghouse Elec. & Mfg. Co., Los Angeles.
F. H. Murray, National Carbon Co., Los Angeles.
A. H. Nylen, Gilson Electric Co., Oakland.
P. F. Oakes, American Ever Ready Co., San Francisco.
W. I. Otis, San Francisco.
F. H. Poss, Benjamin Electric & Mfg. Co., San Francisco.
W. R. Pounder, Hubbard & Co., San Francisco.
H. C. Rice, General Incandescent Lamp Co., Cleveland, Ohio.
H. E. Sanderson, Bryant Electric Co., San Francisco.
W. H. Seaver, American Steel & Wire Co., San Francisco.
M. F. Steele, Benjamin Electric & Mfg. Co., San Francisco.
J. A. Vandegrift, Oakland Lamp Works, Oakland.
C. E. Wiggin, Dunham, Carrigan & Hayden Co., S. F.
C. N. Will, Fobes Supply Co., Portland, Ore.
Garnett Young, Telephone & Elec. Equipment Co., S. F.



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POWER AND GAS

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

The South Yuba Development

The true conservation of water power consists in its complete utilization. Probably nowhere in the West is this principle more completely demonstrated than in the South Yuba hydroelectric development of the Pacific Gas & Electric Company described in this issue, the Spaulding-Drum development, noted more particularly, completing a system which now conserves the entire runoff of a large watershed.

Man has mastered these waters without their knowledge; has furtively extracted their powers. All that he has done though, has been in accordance with its own law for the one thought of the water is hastening downwards. In its vertical fall of 5000 ft. this water is to be used seven times for power purposes. It finally finds its way into irrigation ditches, supplying moisture to over 70,000 acres of deciduous fruit lands which without this irrigation would be of much less value. Many towns and districts are also supplied with water for domestic purposes from this same project which is probably the most complete utilization of a watershed to be found anywhere.

The engineering feats accomplished would a few years ago have seemed impossible. Yet notwithstanding these and other great difficulties met, the project was completed on time. The six months' period of constructing the Lake Spaulding dam is infinitesimal compared with the magnitude of the task.

In this development the mountain, forest, river, earth, and sky have all been combined to be of cooperative service to city and field.

Had there been a clamour of all interests and the greatest pressure brought to bear that both the city and country might be adequately served in the equitable disposal of this wonderful gift of nature—the power of the waters' fall—no more complete and comprehensive development could have taken place. In the final disposition of this water the service of land reclamation alone which has opened up an extensive territory to settlement and productiveness is invaluable.

It is difficult to conceive of any state or municipal institution having undertaken over the period in which this development took place, so complete a conservation of water power upon so diversified a plan. The performance of this company produces a strong argument against exclusive ownership by municipalities of their hydroelectric plants.

Recently a public service commission ordered one company to reduce its rates in a large number of cities and towns. In rendering its decision the commission stated that these new rates were not to be regarded as a controlling precedent by companies owning individual plants, as they are unable to affect the economies which come from a large central generating system. This again, argues in favor of private ownership with the energy sold to the municipality in bulk.

Such efficiency of utilization is evidenced in this development. If revenue is to be produced from such sources, then by the greatest diversity of use individual charges will be proportionately lowered.

Where Specialization Fails.

A specialist is one who has devoted his interested efforts along a certain channel, so that no matter what he has studied or observed, it has all had some bearing upon this main idea; and although this specialization, which occasionally amounts to self-immolation in the interest of the idea, is the result of a desire to be of the greatest possible service to others, it yet contains a danger. That danger is super-specialization.

A wrong interpretation is sometimes placed upon the excellent advice to decide on one occupation, profession, or branch of industry, and then concentrate on the realization of your success along that line. It has been narrowed down to the idea of be a specialist and nothing else, no matter whether the heavens shower adversity or whether for some other reason there is temporarily no use for your specialized services.

This is super-specialization — the somewhat remarkable expression of excess in a sense of limitation.

It is as though the college graduate starting out in the world were to decide to accept no position except that which would call for the application of those ideas gained from past studies. But those ideas were not to be his stock in trade. The studies were but a tool-kit to teach him to think.

The sane specialist does not carry a mental limitator. He is thorough in all things—a man who thinks first; with whom to think is to act, and who acting, still searches for the better way.

The men who succeed are specialists. But the successful bank president did not always occupy that position. Of course not. The possibilities are that he had reached his prime before finance claimed his attention. Then came specialization.

That specialization which is limitation results also in a floating population. These specialists become fastidious about their occupations. They can do a certain thing best, and unless they are able to work at that, they leave the town or district, are next heard from in another state, and then the envelope bears a foreign postmark. This is uneconomical.

Failure to find employment may be due to a lack of completeness. Failure to fathom one's own powers; distortion due to too close observation—a lack of perspective; fear of the unknown. When the specialist's employment is gone he has lost an anchor to windward, but the possibilities are that he may now scour over wider seas and secure treasures greater than his fancy has heretofore conceived.

"As a progressive and evolving being," wrote James Allen, "man is where he is that he may learn that he may grow." In the mental make-up or ability of the specialist may be a lack which change of occupation will supply. Reference to the master minds of the day is unnecessary, for your own experience will have shown you that each circumstance of our lives contains a lesson which rightly mastered makes it possible for us to progress. The bank president is where he is because he has done this. In his experience the humble and perhaps uncongenial tasks mastered, have given way to those considered higher and better.

Be a specialist in that thing which lies nearest to hand, be thorough, and you will succeed. And incidentally, a specialist out of work is a specialist no longer. If he thinks he is, it may be that instead of striving for success through specialization, he is now specializing as a success. The attitude is ludicrous, and the results disastrous always.

Are you, once a specialist, now out of employment? Consider this view. "Thou art weighed in the balances and art found wanting." Do that thing which lies nearest to hand. Fulfill your need, and press on.

Western Distributing Warehouses.

Every manufacturer, except at times when sales exceed output, is compelled to carry stocks that orders may be promptly filled in the interests of good service. Within a comparatively wide radius from the factory the results of this service are felt and appreciated. But where factories are located in the East, western customers are at a considerable disadvantage.

It is rarely the case that manufacturers can carry large local stocks with the necessary warehousemen, clerks and representatives and similarly where only a small margin of profit is allowed electrical jobbers as distributors, it is economically impossible for each and all to carry complete stocks of such appliances, fittings and so on.

There are many reasons for this, among which may be mentioned, uncertainty of demand, changes in styles which are often known to the manufacturer in advance but not to the jobber who may unfortunately buy heavily on passing lines—and so on.

Consigned stocks to jobbers, except where but one handles a line exclusively, may work a hardship on the manufacturer and jobber and result in a higher storage expense than the business warrants.

The most satisfactory solution to this problem is one which would appeal to purchasers in the West because of the promise of prompt delivery it contains, which would appeal to the jobber because more economical and to the manufacturer for the reason that it would tend to reduce the quantities of consigned stocks and at the same time proffer an improved service which would aid in the disposal of his product.

This would need the formation of an Electrical Manufacturers' Warehousing Association having warehouses in the principal distributing centers of the West, the idea being that these would be co-operative distributing points maintained by representative manuacturers from which all jobbers could draw their shelf stocks and large orders.

By such an arrangement, manufacturers, jobbers and purchasers would profit and many losses and annoyances now charged to poor deliveries would be eliminated.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

J. C. Garretson, Fairbanks, Morse & Company, Portland, was in Seattle last week on business.

J. Presbey, Holophane Works of General Electric Company, is travelling throughout the state of Washington.

T. H. McDonnell, formerly of Vallejo, has joined the staff of the California Electric Construction Company.

H. C. Reid, Pacific Fire Extinguisher Company, San Francisco, left on Monday for a two weeks business trip to Portland.

G. W. Bacon, president Sierra & San Francisco Power Company, has returned to New York after a three weeks' visit to San Francisco.

H. C. Goldrick, Kellogg Switchboard & Supply Company, has returned to San Francisco from a trip to British Columbia and the Pacific Northwest.

P. B. Hyde, Edison Storage Battery Supply Company, San Francisco, has left for a trip through southern California and expects to be gone for two weeks.

Elgin Stoddard, vice-president Chas. C. Moore & Company, Engineers, Inc., San Francisco, recently visited the Portland and Seattle offices of the company.

Rudolph W. Van Norden was a guest at the semester banquet of the Stanford University Section A. I. E. E. last week and spoke briefly on engineering subjects.

A. G. Griswold, president A. G. Electric & Manufacturing Company, Seattle, has returned to the San Francisco office after a business trip throughout the Northwest.

K. G. Dunn, vice-president Westinghouse Machine Company, is at Los Angeles on business and expects to remain in the southern part of the state for about two weeks.

E. C. Burkhart, Frank Somers and **C. V. Schneider**, attended a meeting of the executive board of the California Electrical Contractors' Association this week at San Francisco.

S. G. Hughes, pioneer telephone man of Forest Grove, Oregon, who built his first switchboard 19 years ago and his own toll line into Portland, is still actively engaged in the telephone business.

Henry T. Scott, chairman of the board of directors of the Pacific Telephone & Telegraph Company, and President **George E. McFarland** of the same company, have left for New York on business.

A. J. Orem of Boston, Massachusetts, is in Salt Lake City for the purpose of inspecting various Western enterprises in which he is interested, and particularly the Salt Lake and Utah interurban electric railroad.

Charles S. Northcutt, manager San Joaquin division Sierra & San Francisco Power Company, who recently married Miss Mabel Wren of Modesto, Cal., has returned to Modesto, after a honeymoon trip through the Puget Sound district.

S. Henry Barrablough, professor of mechanical engineering, New South Wales University, is at San Francisco and is on his way to London on university business. He was a student formerly at Cornell University and expects to visit that institution on his way to England.

J. E. Latta, for the past two years an associate editor of the Electrical Review and Western Electrician, is now special agent of the Underwriters' Laboratories. Inc., at Chicago, Ill. Mr. Latta, who is a native of North Carolina, a graduate of the University of North Carolina and of the Graduate School of Harvard University, was technical editor of Electrocraft at the time that periodical was absorbed by the Electrical Review. He previously had considerable experience both in the manufacturing and operating ends of the electrical business.

John A. Britton, vice-president and general manager Pacific Gas & Electric Company, entertained a party of guests at the company's new power development at Lake Spaulding. Among those who attended were: **Victor Etienne Jr.**, of Etienne Bros. Cyclops Iron Works; **F. Birdsall**, Union Iron Works; **Carl A. Heise**, Westinghouse Company; **Geo. L. Cameron**, Standard Portland Cement Company; **W. A. Doble**, Pelton Water Wheel Company; **William Schaw** and **J. A. Batcher**, of Schaw-Batcher Company; **W. W. Briggs**, Great Western Power Company; **H. H. Noble**, Northern California Power Company; **John D. McKee**, Mercantile Trust Company; **M. H. de Young, Judge Henry A. Melvin, Charles Sutro, H. L. Cory, Rudolph W. Van Norden, Frank G. Drum**, president of the Pacific Gas & Electric Company; **A. F. Heckenbeamer**, second vice-president and comptroller; **D. H. Foote**, secretary; **Frank B. Anderson, John Martin, C. O. G. Miller, John E. Drum**, directors; **Frank G. Baum**, chief engineer of the project; **R. J. Cantrell, P. M. Downing** and **F. S. Myrtle**, other officials of the company.

MEETING NOTICES.

Jovian League of Southern California.

The League held its regular meeting at Christopher's last Wednesday, with Mr. R. H. Manahan as chairman of the day. Mr. F. L. Woodman, president Los Angeles Harbor Commission, gave an interesting address on "The Harbor & Kilowatt." There was a good attendance. In fact the League has undergone a rejuvenation. The average weekly attendance during the month of November exceeded 100.

Electrical Development and Jovian League.

The semi-annual meeting of the San Francisco Electrical Development and Jovian League, was held at Tait's Cafe last Tuesday. Reports of the various standing committees were received and the following officers elected: W. F. Neiman, president; C. A. Heise, vice-president; E. B. Strong, secretary-treasurer; P. C. Butte and Edw. Whaley, members executive committee. Addresses were made by the retiring and newly-elected presidents. Due to the holiday season the meeting stood adjourned until the second Tuesday in January.

Utah Electric Club.

At the regular luncheon of the Utah Electric Club at the Commercial Club last Thursday, Frank A. West, director of the Experiment Station of the Agricultural College of Utah, delivered an intensely interesting talk on the subject of "Radioactivity." About fifty members were present.

H. T. Plumb of the General Electric Company was elected chairman for February and W. W. Torrence was appointed vice-chairman of the entertainment committee on account of the absence from the city of H. F. Holland, the chairman.

On account of the fact that on Wednesday, December 10th, all of the civic organizations of the city will celebrate Utah Products Day by a monster luncheon at the Commercial Club, the Electric Club voted to join in the observance, so that the next luncheon will be held on Wednesday instead of Thursday.

Portland Sections, A. I. E. E. and N. E. L. A.

The third joint meeting of the above associations was held at the Hawthorne Building, Portland, on the evening of December 2, 1913, when O. B. Coldwell, general superintendent Portland Railway, Light & Power Company, read a short introductory paper on Recent Regulative Measures Affecting Public Utilities. The various measures were discussed and further explained by the following: H. R. Wakeman who dealt more particularly with the Proposed Joint Pole Agreement, for Portland, by W. H. Evans, who discussed General Regulations governing Overhead and Underground

Construction. The application of these was taken up by D. F. McGee, who was followed by B. C. Condit, who took up the question of Station and Substation Construction in the state of Washington. Just as the last speaker, W. D. Scott, was closing his remarks on Co-operation with the Railroad Commission of Oregon, four fake policemen arrived and arrested Mr. Coldwell who was immediately arraigned before a "Kangaroo" court which had been staged behind a curtain A burlesque charge was made against Mr. Coldwell, the final result being his acquittal. The 200 members present were then served with refreshments, consisting of pumpkin pie and apple cider.

TRADE NOTES.

Raymond Spencer of Santa Barbara has secured the contract for wiring the new postoffice in that city.

The Edison Storage Battery Supply Company announces the removal of its San Francisco branch office to 441 Golden Gate avenue.

Newberry, Bendheim Electric Company, Los Angeles, were awarded the electrical contract on the San Francisco Auditorium for $16,500.

The electrical contract for the Physicians' Building, Sutter and Powell streets, San Francisco, has been awarded to the Butte Engineering & Electric Company for $4900.

The Kellogg Switchboard & Supply Company has secured an order for complete central office equipment for the Independent Telephone Company, Forest Grove, Oregon.

NEW CATALOGUES.

Druid Glass is described and listed in a recent pamphlet issued by Holophane Works of G. E. Company, Cleveland, Ohio. Stonehenge is the name of the latest Holophane design, the design in which Druid glass will be supplied.

The department of commerce has issued the second edition of Circular No. 32, of the Bureau of Standards on Standard Regulations for Manufactured Gas & Gas Service. This bulletin supersedes the first edition of Circular No. 32 issued April 1, 1912.

The report of the National Electric Light Association committee on resuscitation from shock, being distributed by the association in bulletin form, contains information of considerable importance to the whole of the electrical industry on this subject.

The Illinois Electric Company, Los Angeles, Cal., have issued a new catologue (No. 21) containing approximately 1000 pp. listing the material available for distribution by them. The catalogue is said to be very complete and comprehensive and should prove a valuable book of reference to the trade.

The Quality of Surface Waters of California is the title of Water-Supply paper No. 237 by Walton, Van Winkle & F. M. Eaton, published by the department of the interior, Washington, D. C., and for free distribution. The report contains a large amount of information concerning the streams and lakes of California.

New Reflectors and How to Use Them is the title of a new bulletin issued by the Crouse-Hinds Company, Syracuse, New York, which is devoted to reflectors for use in roundhouses, steel mills, etc. The bulletin also contains instructions as to how and where the reflectors should be mounted to give maximum results.

The Ohio Brass Company, Mansfield, Ohio, are distributing a splendid booklet which illustrates and describes the construction details of thirty prominent catenary roads. Construction methods in general are also described and a specification blank for catenary construction is also included. It is a valuable booklet on this subject and a companion to the company's general catalogue which is also mailed on request.

The Chicago Pneumatic Tool Company, Chicago, Ill., has issued Bulletin No. 34-D on "Chicago Pneumatic" Corliss Compressors, Steam Driven; 32 pp. It presents the principal features of their compressors of standard design and for capacities from 1000 to 6000 cu. ft. per minute for all usual air or steam pressures condensing and non-condensing. Constructional and mechanical details are fully described and actual installations are also illustrated.

"Motor Driven Refrigerating & Ice Making Machinery" is the title of a publication (Section 3133) just issued by the Westinghouse Electric & Manufacturing Company. This pamphlet gives some exceedingly interesting information. including data on motor applications, together with actual kw.-hr consumption for different plants. Illustrations are shown of various installations and a curve is given showing the horsepower required for refrigerating machines of different capacities.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The railroad commission rendered a decision granting authority to the California Telephone & Light Company to issue $100,000 of bonds and $50,000 of stock, the proceeds of which will be devoted to new construction and equipment, and refunding indebtedness.

A decision was rendered authorizing Mary E. Backus to sell a water system in Eagle Rock to the Eagle Rock Water Company for $7596 of stock.

Authority was granted the Los Verjela Land & Water Company to mortgage its property in Yuba county to the Bank of Rideout, Smith & Company of Oroville as security for a note of $25,000. The proceeds will be used for the construction of a dam on Dry Creek.

The company was also granted permission to issue $65,750 of stock for the purpose of paying off a loan and for extensions.

The Coachella Valley Ice & Electric Company applied for permission to issue $300,000 of bonds for the construction of electric distribution lines in and around Coachella and Imperial Valleys.

An adjustment was affected reducing freight rates on the Southern Pacific throughout the Sacramento Valley.

BOOK REVIEWS.

Light Radiation and Illumination, translated from the German of Paul Hogner by Justus Eck; 88 pp.; 5½x9 in.; cloth bound. Published by D. Van Nostrand Company, and for sale by the Technical Book Shop, Rialto Bldg.; San Francisco. Price $2.50.

This book is intended to assist electrical engineers, architects, central station salesmen, and others in planning lighting installations, and deals especially with the problems arising in connection with arc lighting. The problem of street lighting is dealt with in considerable detail and new methods are given for the calculation of street and surface illumination. The book gives rules and practical information that will enable good and reliable results to be secured and is an invaluable addition to the works relating to the engineering of illumination.

Electrical Engineering. By Clarence V. Christie, M. A. B. Sc.; 417 pp.; 6x9½ in.; cloth bound, and contains 377 diagrams. Published by McGraw-Hill Book Company, New York, and for sale by Technical Book Shop, Rialto Bldg., San Francisco. Price $4.

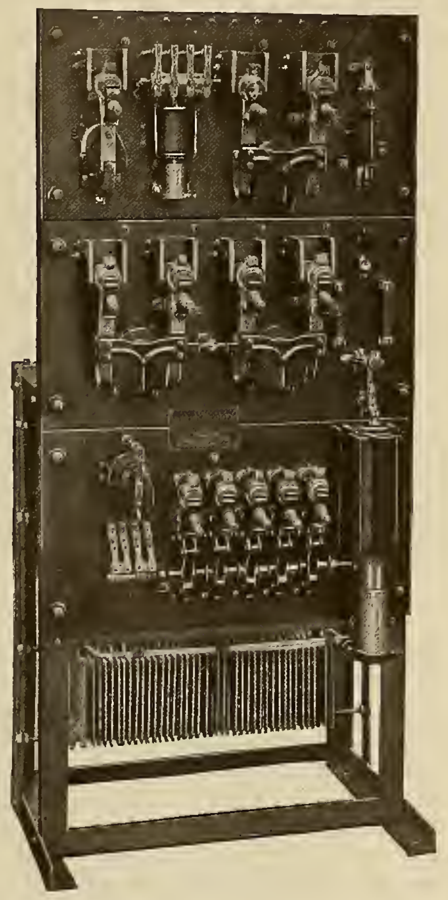
In this work the theory and characteristics of electrical machines are developed from the fundamental principles of electro-statics and electro-magnetics. There are chapters on electric circuits, direct current machinery, synchronous machinery, alternators and synchronous motors, transformers, induction motors, alternating current commutator motors, converters and the transmission line, and each is very thoroughly discussed. It was originally compiled as a foundation for lecture courses for junior and senior students in electrical engineering.

INDUSTRIAL

ELEVATOR CONTROLLERS THAT INSURE SAFETY.

In the design of Bulletin 7560 type full magnetic elevator controller the control system is laid out so that even should grounds or short circuits occur in the cables or switches, no damage to the elevator or its occupants can result. Failure of any part of the equipment to function properly results in the slowing down of the elevator and bringing it to a stop. The latest design of controller, the panel of which is shown in the accompanying illustration permits of all the refinements of control that can be used in connection with direct current motors.

These standard controllers, built by the Cutler-Hammer Manufacturing Company, Milwaukee, are furnished in either



Cutler-Hammer Magnetic Elevator Controller.

"single speed" or "two speed" types, both types being equipped with the slow-down feature. The single speed types are used with motors that have no field control. The two-speed controllers are used with motors having additional speed variation by means of shunt field resistance. The slow-down feature is obtained in both cases by means of the combination of armature series and shunt resistances. The armature shunt resistance is used also for dynamic braking.

The magnetic switches mounted on the slate control panel are simple and rugged in construction, and can easily be taken apart for inspection or for renewal of the contacts. All switch arms have a channel section, and other parts are heavily ribbed where required so as to eliminate the breakage of any of these parts.

All electrical contacts on these panels are "butt" type, carbon to copper. These contacts have a wide range of adjustment for taking up wear, thus insuring maximum life. Dust and dirt cannot collect on the contacts, because they are vertical.

The main contacts are equipped with magnetic blow-outs, the blow-out coil being of bar wound copper, mounted on the back of the control panel, so that these coils cannot burn out nor be damaged from the arc itself. All of the wiring is exposed on the back of the panel, and all terminals are accessible.

A double-pole main line switch breaks both sides of the line, and in connection with the direction switches gives four breaks in the armature circuit. The direction switches are mechanically interlocked to prevent their simultaneous operation, which would cause a short circuit on the line. These switches will automatically open on abnormal drop in voltage and stop the equipment.

A double coil overload movement is arranged to stop the elevator in case of overload, and can be automatically reset by throwing the car switch to the off position. This gives a reliable indication as to whether the car is overloaded and by having the resetting feature in the car switch, it is possible to set this overload within the closest limits. This device therefore possesses an advantage over the hand-operated circuit-breaker in that the operator is not compelled to go to the switchboard in case a slight overload occurs. The only thing necessary is to lighten the load on the elevator. With a manually operated circuit-breaker the operator, under these conditions, invariably increases the current setting of the breaker when he goes to the panel to reset it, and, in case of continued tripping, eventually ties the breaker in, thus eliminating the overload protection which the circuit-breaker is designed to give. Besides the main controller panel and the car switch, all the electrical accessories required for the control of electric elevators are made by the Cutler-Hammer Manufacturing Company.

WESTINGHOUSE MACHINE COMPANY.

At a recent meeting of the executive committee of the Westinghouse Machine Company an appropriation of $125,000 was made to provide additional manufacturing facilities required to take care of the rapidly increasing business which has been enjoyed recently, owing in a large measure to the new lines of products developed, and particularly the following: The impulse turbine which is being used by central stations, railways and industrial plants; the reduction gear, which in addition to the demand for marine installation, is finding a wide field of application in connection with large direct current generators. The gear is interposed between the high speed of the turbine and the low speed of the direct current machine with its commutator. Orders for automobile rotary valve motors have also contributed to increasing need for additional equipment.

The department manufacturing air springs for automobile trucks has also felt the influence of increased business. These air springs are interposed between the chassis and the body of the truck and materially reduce the jar and vibration. They have proved exceedingly popular for this class of vehicle. The company contemplates devoting a portion of the appropriation to securing additional machine tools designed to use high-speed tool steel, fully realizing their advantages, and thus adding to the already well equipped shop which this company now has in operation.

NEWS NOTES

FINANCIAL.

LOS ANGELES, CAL.—The Huntington interests in Los Angeles have contracted for the placing of a bond issue of $14,000,000 for extensions and development work in Southern California. The proceeds of the issue will be allotted to the Pacific Light & Power Corporation, the Los Angeles Railway Company and the Huntington Land Company. The Los Angeles Railway Company is to absorb the City Railway Company, which was organized about three years ago to provide for the extensions which were forced upon the city lines at that time.

SALT LAKE CITY, UTAH.—A well-founded statement is in circulation that the Utah Power & Light Company has acquired the $1,350,000 bonds and practically all the $1,000,000 stock of the San Juan Water & Power Company of Colorado. The deal takes with it the control of the Durango Gas & Electric Company. The San Juan Water & Power Company owns and operates several plants on the Animas River near the Denver & Rio Grande Company, in southwestern Colorado. It was owned by interests identified with the Colorado Power Company, with headquarters in Denver. The acquisition of the San Juan company is understood to be a step toward the formation of another big combination of power concerns in Colorado. It will be turned over to the Western Colorado Power Company, which was incorporated last March with $5,000,000 capital. The Western Colorado Power Company has already acquired all the power plants in this state, formerly owned by the Telluride Power Company, which were sold last December to the Utah Power & Light Company.

INCORPORATIONS.

OAKLAND, CAL.—Articles of incorporation of the Hayward Water Company have been filed with the county clerk. The recited purpose of the corporation is to furnish water to towns and cities. The concern is capitalized for $200,000, divided into 2000 shares with a par value of $100. Platt Kent of San Francisco, Oscar Sutro of Piedmont and C. Ramsey of Oakland are directors.

LOS ANGELES, CAL.—The Los Angeles Railway Corporation and the City Railway of Los Angeles, have filed articles of incorporation here and with the secretary of state at Sacramento, providing for the consolidation under the name of the Los Angeles Railway Company. Under reorganization, with W. E. Dunn, C. A. Henderson, G. E. Ward, S. W. Haskins, J. E. Brown, Frank Griffith and Albert Crutcher as incorporators, $5,000,000 of stock of the two former companies will be wiped out and the new company capitalized at $20,000,000. The new company will issue bonds in the sum of $23,500,000 to cover the indebtedness and $26,500,000 to build tunnels and make other improvements.

SALT LAKE CITY, UTAH.—The Salt Lake Terminal Company, organized to construct and operate a union terminal for the Salt Lake and Ogden Railroads, commonly called the Bamberger line, and the Salt Lake & Utah Railway Company, the new line which the Orems are building south from Salt Lake City, has recently filed articles of incorporation. The company is capitalized at $1,000,000. Julian Bamberger, president; J. H. Devine, vice-president; F. M. Orem, secretary and treasurer, and J. B. Bean, Henry I. Moore and W. R. Armstrong are the incorporators and directors. The company has acquired property in the blocks between Second and Third South and Main and Second West at a cost of $150,000, which will be utilized for the erection of the necessary terminal buildings.

ILLUMINATION.

SEATTLE, WASH.—The contract for ornamental street lighting has been let to H. G. Behneman for $2,032.16.

SAFFORD, ARIZ.—The Gila Valley Electric, Gas & Water Company is busy on a proposition of securing a complete up-to-date electric light plant for this town.

LOS ANGELES, CAL.—Sealed bids will be received up to December 22d, by the board of supervisors of Los Angeles county, for installing and maintaining additions to the street lighting system in Westgate Lighting District.

SACRAMENTO, CAL.—Action has been taken by the city council to compel the property owners west of Fourth street between I and M streets, who have not so far installed electroliers to do so. The work will cost about $9691.

SAN JOSE, CAL.—Application has been made by the Pacific Gas & Electric Company for a franchise for the transmitting of electricity in the town of Alviso. Sealed bids will be received up to January 5, 1914 for the sale of the franchise to the highest bidder.

RAYMOND, WASH.—Henry W. Urquhart of Chehalis and John Stewart of Seattle have filed their written acceptance with the city of Raymond of the franchise granted them recently to supply gas to the city. The time limit set in the franchise for installing their plant is 18 months.

LOS ANGELES, CAL.—The city council, by a vote of 5 to 3, ousted President McReynolds of the board of public utilities, thus making operative Mayor Rose's order of removal. Following this, Mr. A. W. Wright resigned, setting forth his reasons that he was jointly responsible with Mr. McReynolds for the gas controversy. The third member of the board, Mr. Martin Bekins, is in New York.

RIVERSIDE, CAL.—The city council has authorized the mayor to enter into a contract with the Pacific Light & Power Company, revocable at pleasure of the board, to operate and maintain a pole line from Santa Ana River running over private property to Jurupa avenue, near the junction of Jurupa and the Salt Lake Railroad to New Magnolia avenue, and the right to operate a three-wire circuit on a pole line of the Pacific Electric.

HELENA, MONT.—The public service commission of Montana has ordered the Montana Power Company to reduce its rates in the thirty-one cities and towns in which it operates. The reductions vary from 12 per cent to 50 per cent. The commission in rendering this decision, states that these rates are not to be regarded as a controlling precedent by companies served by individual plants, which because of their separate organization are not able to effect the economies that come from a combined management such as is furnished by the Montana Power Company.

TRANSMISSION.

SUSANVILLE, CAL.—The Lassen Electric Company has been granted a franchise to construct and operate poles, towers and others super-structures for transmitting electricity in the county of Lassen.

LAS VEGAS, NEV.—An order has been issued by Secretary Lane, with the president's approval, creating a power site reserve in Boulder canyon, on the Colorado River, 20 miles east of this city. It is expected the construction will develop 40,000 h.p. at a minimum of expense.

SAN FRANCISCO, CAL.—N. W. Halsey & Company, and N. W. Harris & Company have purchased from the Pacific Gas & Electric Company an additional block of $500,000 of the 6 per cent secured gold notes of that company, dated July 1, 1913, due June 25, 1914, which is additional to $4,500,000 heretofore purchased and distributed by the same houses. The generating capacity of the company's plants at the present time is 212,493 h.p., which includes the first unit of the Lake Spaulding development now in successful operation.

SEATTLE, WASH.—Submission of a bond issue of $250,000 in order to provide funds for the acquirement by condemnation of the Lake Cushman power site is proposed by Councilman Oliver T. Erickson. The bill providing for the condemnation of the site was introduced some time ago. It is proposed to condemn several thousand acres of land around Lake Cushman, using the lake as an impounding reservoir. The plan calls for the construction of a dam across Skokomish River and the entire undertaking is estimated to cost between $5,000,000 and $6,000,000.

LOS ANGELES, CAL.—The failure of some bolts in an expansion joint, at the Big Creek plant of the Pacific Light & Power Corporation, allowed the penstock to open about 300 ft. above the power house, and service was interrupted. Repairs have been made and no great inconvenience was experienced. Arrangements are being made to deliver the full load capacity of the present development. During the break a few days ago, which put the upper plant out of commission for a brief period, one of the units in the lower plant was started up and relieved the situation temporarily. Two 20,000 h.p. units at each station will be in service in a few days. It is proposed to operate at 135,000 volts until the second transmission line to Los Angeles is completed.

LOS ANGELES, CAL.—Terms under which the Aqueduct will be transferred from the board of public works to the board of public service have been practically agreed upon, and the council is prepared to take action, making the transfer complete. According to the agreement, the board of public service will take over the salvage on the Aqueduct construction, which has been roughly appraised at $1,400,000, and will assume the obligations of the board of public works. These obligations amount to approximately $445,000, including a loan of $236,000, made by the water department to the Aqueduct Bureau. The proceeds from the salvage will be used by the board of public service for further construction work on the Aqueduct. It has not been determined yet, which board shall have control of the Aqueduct Power Bureau.

SALT LAKE CITY, UTAH.—January first is the date set by the Utah Power & Light Company for the delivery of the first electric power from its new plant, Bear River, Grace, Idaho. It is expected that the new eleven-foot pipe line which conveys the water from a point 23,000 ft. up the river to the plant will be ready for delivery of water to the turbines at that time. This new plant will develop 33,000 h.p. The power house is 45 ft. wide and 156 ft. long. This power and that developed by the present plant at Grace will be transmitted directly to the company's new substation, about three miles west of Salt Lake City by means of a 135-mile steel tower line, from which point it will be distributed to the Utah Light & Railway Company, who purchase a large block of power from the company, to Bingham and Garfield, where large quantities of power are used by the copper mines and smelters, and to the suburban territory served by the Utah Power & Light Company.

REEDSPORT, ORE.—The department of agriculture has issued a permit to Jas. Lindsey of Portland, Oregon, for the operation of a power plant on Mill Creek, Douglas county, Oregon, within the boundaries of the Linslaw national forest. The power will be transmitted at 22,000 volts to Reedsport, a distance of 18 miles, where it will be used in the manufacture of pulp. Besides, the power plant and pulp mill, other industries are contemplated. In connection with the power development a rock-fill dam about 30 ft. in height and 126 ft. maximum length is to be constructed at the outlet of Loon Lake, which has an area of 265 acres. By providing a depth of 20 ft. between the surface and the outlet pipe, storage of about 4800 acre ft. will be obtained. The conduit is to have a total length of four-fifths of a mile, the greater portion of which is to be wood-stave pipe 5 ft. in diameter. The power house is to be constructed with a concrete foundation, timber frame and sheet iron covering. There will be installed three 1150 h.p., horizontal, Francis-type turbines, acting under a head of 263 ft., these being direct-connected to three 750 k.v.a., 3-phase, alternating-current generators.

TRANSPORTATION.

LOS ANGELES, CAL.—Plans are being made by the Pacific Electric Railway to install a $20,000 inter-locking plant at the crossing of the Santa Fe near Cucamonga. The state railroad commission has agreed to the installation.

CLOVIS, CAL.—An application has been made to the board of trustees by F. S. Granger for a franchise to construct and operate an interurban electric railway in this city. Sealed bids will be received up to January 5th for the sale of the franchise.

TACOMA, WASH.—The Oregon-Washington Railway & Navigation Company will construct two new lines next year, one to Olympia and the other to South Bend and Raymond in the Willapa harbor district. It is estimated that this work will cost $5,000,000.

PORTLAND, ORE.—On the ground that the recently passed six-for-a-quarter fare ordinance violates the Federal Constitution, the Portland Railway, Light & Power Company has obtained a temporary injunction restraining the city from enforcing the ordinance. The order was granted in the federal court. It was contended that the public utilities law placed the jurisdiction of fares in the hands of the state commission.

TWIN FALLS, IDAHO.—December first marked the completion of the first four miles of the new electric storage battery railway being constructed by I. B. Perrine to the Great Shoshone Falls. The event was celebrated by the public schools of this city in recognition of the fact that commencing on that day the school children living along the route will be transported to the city schools by the electric trolley car pending the completion of the line and its opening for regular operation.

TELEPHONE AND TELEGRAPH.

CENTRALIA, WASH.—A franchise has been granted by the Lewis county commissioners to the Salzor Valley Telephone Company for a line up Salzer Valley east of Centralia.

PORTLAND, ORE.—The railroad commission has ruled that the Pacific Telephone & Telegraph Company must connect their trunk lines onto a switchboard supplied to a subscriber—the Oregon Hotel, by the Home Telephone Company.

SEATTLE, WASH.—Richland Valley farmers have organized a country telephone system called the Yakima & Columbia River Telephone Company. It will probably be incorporated for $2500. The officers are: E. E. Floyd, president; J. R. Gardener, vice-president; Wm. Reed, secretary.

TUCSON, ARIZ.—C. H. Gaunt, general manager of the Pacific division of the Western Union Company, states that a large sum of money is to be expended in the improvement of facilities in the Western Union office at Tucson. The main trunk lines to Chicago are to be supplemented with further wires, and many smaller improvements are to be made.

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JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

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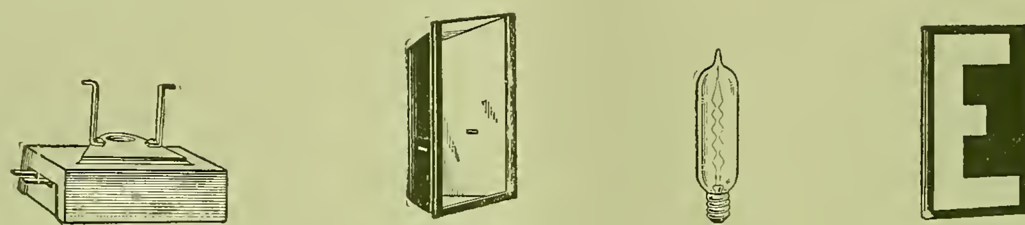
The New Miniature Electric Display Signs

for window office, shop, apartment store, theater and railroad use.
Each unit consists of four parts,



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and when combined make a neat, attractive, legible, distinct letter.

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The letters have a transparent glass background with opaque borders, giving them a sharpness and distinctness, which enables them to be read at a distance.

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④ JOURNAL OF ELECTRICITY ④
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXI | SAN FRANCISCO, DECEMBER 20, 1913 | NUMBER 25

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STATION "A"—SAN FRANCISCO DISTRICT

BY FRANK H. VARNEY.

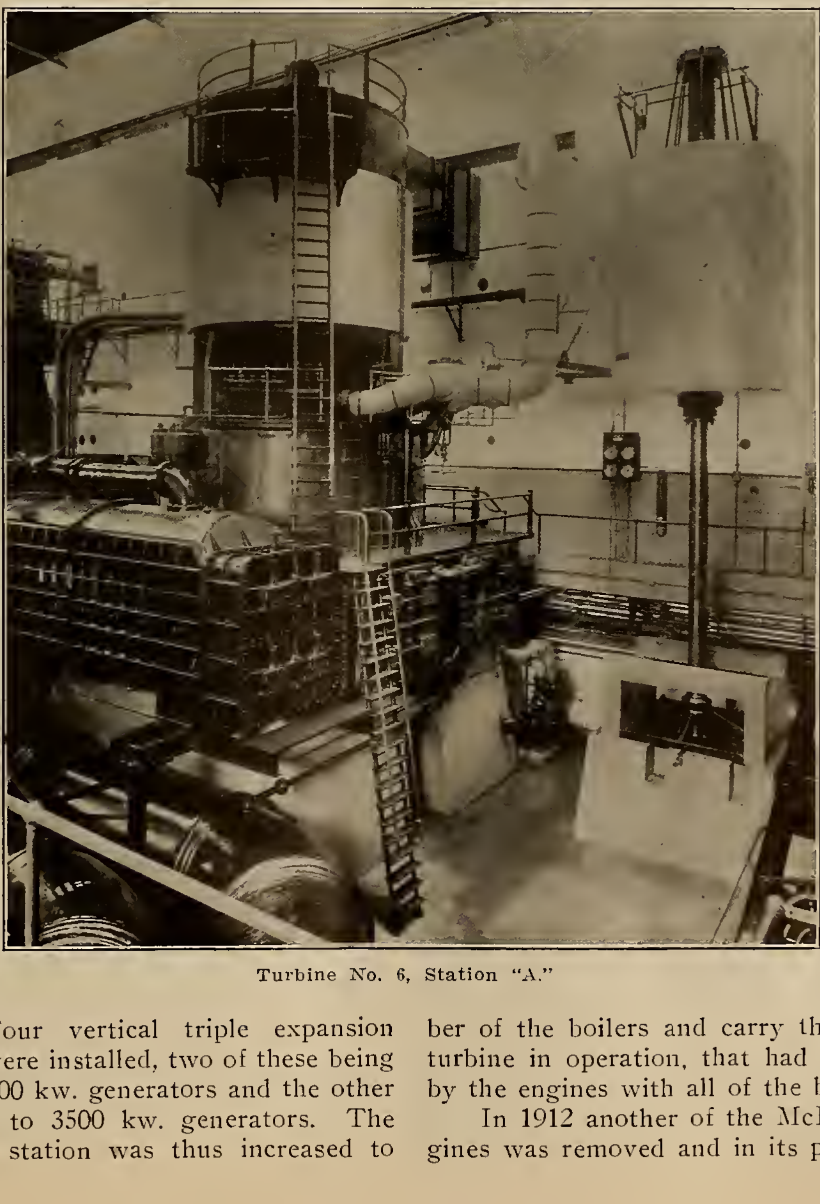
(In this article the equipment is described of the main electric generating station of the Pacific Gas & Electric Company in its San Francisco District. In this plant the prime movers of but a decade ago have been entirely replaced by turbines which double the capacity of the plant.—The Editors.)

The main electric generating station in San Francisco, known as Station "A," is located in the Potrero District and occupies an entire block on Louisiana street, from Twenty-third street to Humboldt street. The building is of massive brick construction, divided longitudinally into the engine room and the boiler room, each of which runs the full length of the building.

The original plant, which was completed in 1901, consisted of six engines and fifteen boilers. The engines were McIntosh & Seymour vertical, compound direct connected to Westinghouse generators. Five of these machines were of 1500 kw. capacity and the sixth, 500 kw.

The fifteen boilers were all Babcock & Wilcox 524 h.p. built for 200 lb. working pressure. The plant was equipped with Green Economizers and induced draft fans. As originally built, therefore, the station had a capacity of 8000 kw. in engines and 7860 boiler h.p.

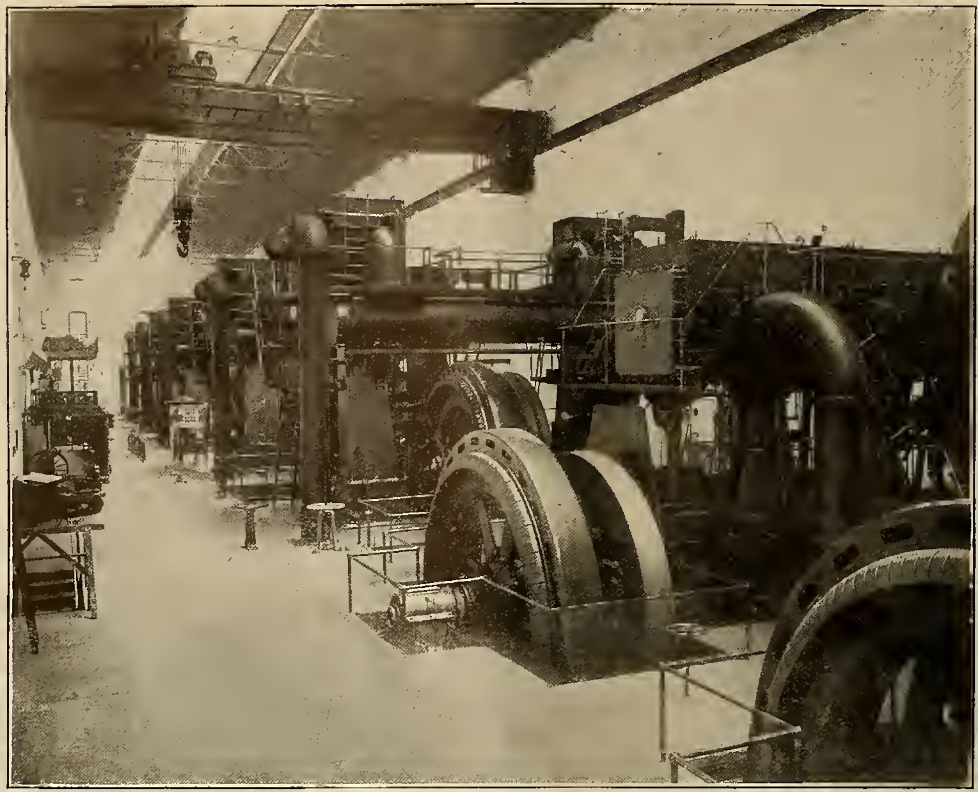
In 1905 additions were made to both the engine room and the boiler room equipment. Four vertical triple expansion marine type engines were installed, two of these being direct connected to 1500 kw. generators and the other two direct connected to 3500 kw. generators. The total capacity of the station was thus increased to 18,000 kw. At the same time the boiler capacity was more than doubled by adding six 686 h.p. Babcock & Wilcox boilers equipped with superheaters, and six 541 h.p. Heine boilers, making a total capacity of 15,222 h.p. The plant remained with this equipment until 1910 and during this period the greatest load that was ever carried was approximately 21,000 kw.


Turbine No. 6, Station "A."

In 1910 the first steam turbine installation was made. One of the 1500 kw. McIntosh & Seymour engines was removed and in its place was installed a 12,000 kw. vertical Curtis turbine. This is a five-stage machine and is provided with a base condenser with an auxiliary wing, having a total of 25,000 sq. ft. of cooling surface.

At the same time that this installation was made, 10 of the original Babcock & Wilcox boilers were equipped with Foster superheaters designed to superheat the steam 100 degrees. This is the only addition made in the boiler room as, owing to the much greater economy of the turbine, it was possible to shut down a number of the boilers and carry the same load with the turbine in operation, that had formerly been carried by the engines with all of the boilers in service.

In 1912 another of the McIntosh & Seymour engines was removed and in its place a 15,000 kw. tur-



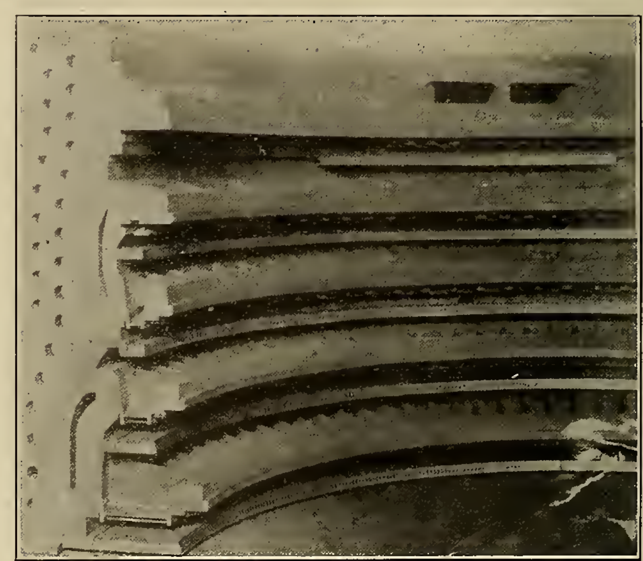
Interior Station "A" Prior to the Installation of Turbines.

bine was installed, this machine having 10 times the capacity of the engine which it replaced, although occupying no more space. This machine is similar to the first turbine installed except that it has six stages instead of five and its base is large enough to contain all the cooling surface required for the condenser.

There is now being installed a third turbine of 15,000 kw. capacity which is being placed in the space formerly occupied by the two 1500 kw. triple expansion engines. This machine is also of the Curtis vertical type, is designed for 175 lb. pressure, 100 degrees superheat and 28½ in. vacuum and provided with seven stages. Each of the first six stages has two wheels, each wheel containing 672 buckets, making 1344 buckets per stage. The seventh stage has only one wheel containing 560 buckets. The turbine contains, therefore, 8624 movable buckets. The buckets in the stages increase in length as the steam expands. In the first three stages the length of the buckets runs from 1 in. to 1¾ in. while in the last stage the buckets are almost 20 in. long. There is a free area of approximately 36 sq. ft. between the buckets in the last stage.

The condenser for this machine contains 29,000 sq. ft. of cooling surface made up of 1 in. tubes 18 ft. 2⅝ in. long, the entire condenser being installed in the turbine base. The condenser is divided horizontally into two passes for circulating water so that the water flows through the lower half of the tubes, then up and back through the upper half of the tubes. A portion of the cooling surface is separated from the circulating water so as to form a Voltz heater. The condensing steam is forced through the tubes of the Voltz heater after being withdrawn from the condenser. By this means the temperature of the condensate is kept within a few degrees of the temperature due to the vacuum.

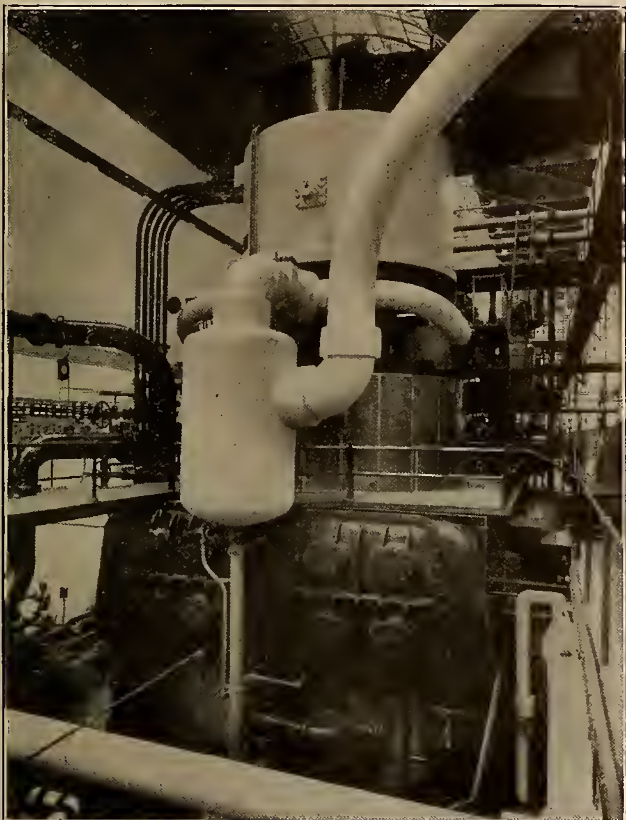
The machine is provided with a complete set of auxiliaries, the principal ones being a dry vacuum pump having a 16 in. steam cylinder, a 42 in. air cylinder, with a common stroke of 24 in.; the two wet vacuum pumps having 8 in. suction and 6 in. discharge. These are two-stage centrifugal pumps, one of which is driven by a 30 h.p. Terry turbine and the other by a 30 h.p. General Electric motor. The oil for the step bearings is handled by two Dean horizontal duplex pumps operating at a pressure of 1200 lb. per sq. in. There is a 10x6x10 Worthington pump for pumping the oil to the guide bearings. The step



Segment of 12,000 kw. Turbine Showing Intermediate Buckets and Nozzles.

bearing and guide bearing pumps are connected to the corresponding systems of the other two turbines.

When this machine is in operation it will be possible to carry a load of 42,000 kw. on the three turbines with the same equipment of boilers as was provided for the reciprocating engines. This is just double the capacity it was possible to obtain from the station when using these same boilers when operating reciprocating engines.



Turbine No. 5, Station "A."

Circulating water is obtained from the bay, all the circulating pumps being located in a separate pump house located about 1000 ft. from the station. The water for the turbines is pumped through a 60 in. cast iron pipe which was installed at the time of the first turbine installation.

Quartz tube vapor lamps, like many other inventions, are being put to a variety of uses different to that for which they were originally intended. The excessive ultra-violet rays emitted, which first proved a detriment to the lamp, now finds application for it in new fields.

In Europe, carpet manufacturers who previously were put to considerable expense in shipping samples of their manufactured product to sunny southern countries, so that proper tests of the sun-resisting qualities of the colored fabrics could be made, now use the quartz lamp for that purpose. It is stated that at Rouen sterilization of water is effected, by the use of the quartz lamp, at the rate of 100,000 gals. per day. The capacity of the lamp used is only 750 watts. Much larger plants are also in successful operation.

Sterilization of water in the home in this way is a possibility, and may soon become a new and profitable central station load.

ELECTRICITY AND THE FIRE HAZARD.

BY J. H. MONTGOMERY.

(Treating his subject in an interesting historical manner, the author first describes the birth and growth of the National Electrical Code; refers to the great hazard of early equipment as compared with that now used, and mentions also where electricity aids in reducing the fire hazard. The paper was originally presented before the Los Angeles Section, A. I. E. E., by the author. Mr. Montgomery is Associate Professor of Electrical Engineering at the University of Southern California.—The Editors.)

While Faraday's discovery of the induction of electric currents dates back more than eighty years and Gramme and Siemens built practical generators over half a century ago, the commercial use of electricity is a matter of comparatively recent date.

The Pearl Street Station in New York City is said to have been the first central station for the production and distribution of current for public use. It was put into service in 1882. The first general introduction of electric lighting took place however in the preceding year when a number of installations were made in the textile mills of New England.

One of the unexpected consequences of this use of current was a new fire hazard. The Manufacturers' Mutual Insurance Companies had insurance on sixty-

Home-Made Knife Switch.

five of these textile mills in which electric lights had been installed and during the first six months twenty-three fires from electrical causes took place in these properties. Following these and other similar experiences elsewhere the need of rules governing the installation of electric apparatus became evident. Mr. J. C. H. Woodbury, the engineer of the Mutual Insurance Companies, drew up what was probably the first set of such rules. These rules were compiled after consultation with Dr. Chas. F. Brush, Prof. Elihu Thompson, Mr. Edison, Mr. Weston and others.

From time to time other rules were formulated by various insurance organizations, manufacturing companies, municipalities and other bodies. Most of these were sincere attempts to secure safe construction. A few however were framed in the interest of certain articles so as to eliminate competition. These local rules varied greatly in their requirements so that what was demanded in one place was prohibited somewhere else and great confusion resulted. This condition was the subject of careful consideration at a meeting of the National Electric Light Association held in Cleveland in 1895. A committee was appointed at that meeting to consider the matter of rules. It soon became apparent that it was a thing beyond the scope of any one organization and accord-

ingly arrangements were made for a conference on rules which was held in New York City on March 18, 1896. All interested persons were invited. The various national bodies, insurance interests, manufacturers, inspectors and contractors were represented. Several days were spent in the conference. A large book was prepared with the various American, English, German and French rules pasted in parallel columns so that comparison could be made. The conference finally

Insulator Made of Wood Plug and Piece of Garden Hose. Part of Lag Screw and Guy Wire Burned Off by 110 Volts When Grounded to Tin Roof.

appointed a committee with Prof. Francis B. Crocker of Columbia College as chairman. After an immense amount of work extending over several months the committee compiled the first National Electrical Code which was issued in the Fall of 1897. It consisted of a little book of 52 pages and was endorsed by the various interests represented in the conference.

The Code Conference continued its work of revision and addition in co-operation with the Electrical Committee of The National Board of Fire Underwriters until a few years ago when it was all turned over to the Electrical Committee of the National Fire Protection Association.

As a sort of supplement to the National Code a List of Approved Fittings is published twice a year by the National Board of Fire Underwriters on the recommendation of the Underwriters' Laboratories.

The Laboratories were established in 1894 by the National Board for the purpose of making tests relating to the fire hazard. They have seven departments, viz: Protection, Structural Material, Gases and Oils, Chemical, Hydraulic, Signaling Apparatus, Electrical.

In the electrical tests the intention is to reproduce the worst possible operating conditions. Sockets are turned off and on by an automatic device until they either fail or pass the required number of operations, which is very high. Fuses are tested by being blown when surrounded by cotton. Rubber covered wire is subjected to insulation and breakdown tests. These tests are very thorough and are made by competent technical men.

The work is carried still further by means of factory inspection with frequent tests of the product. Labels are supplied to manufacturers whose goods are thus inspected in the factory and the presence of these labels means that the goods are up to requirements. A place in the List of Approved Fittings means that the manufacturer can make satisfactory material, the use of the label, that he is doing so.

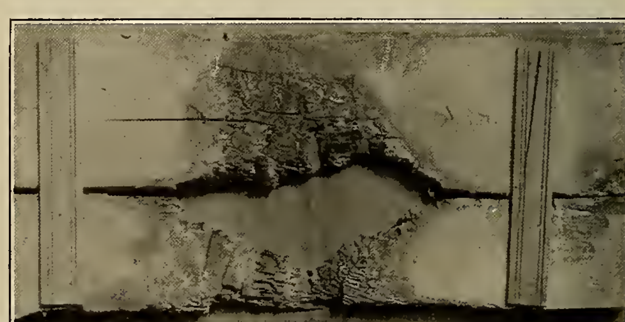
Through the Code and the List of Fittings then we have a standard of material and installation. Why are all these elaborate precautions necessary? Because electricity has come to be a serious factor in the fire hazard. An examination of reports as to the causes of fires will show from one to eight or ten per cent attributed to electricity. To these must be added a certain proportion of the "cause unknown" fires. Even after making due allowance for the propensity of reporters and fire marshals to lay anything which they do not understand to "defective wiring" it will be evident that probably two or three per cent of all fires are due in some way to electricity. Investigation also shows that fully 75 per cent of these fires are from avoidable causes.

We may class these electrical hazards as Inherent and Avoidable.

Avoidable hazards may come from several causes such as poorly designed fittings, improper materials, wrong use of apparatus or poor workmanship. The history of the fuse block illustrates very well all of these points. At first a cutout was simply a piece of lead wire held under two screws on a wooden block. Then some genius put a bit of mica under the fuse. Here the material was wrong, since wood is inflammable and the design was bad in providing too small a separation of polarities and too small a break. The old "bug" and "horseshoe" canopy cutouts were examples of the same faulty design. Then came the "Sawyer-Mann" and "Edison" blocks of the link fuse type. The latter was very satisfactory in point of design but shared the objection of using porcelain. Porcelain is too fragile to withstand the blowing of heavy fuses; furthermore after continued use metal is deposited upon it until finally it will "arc over" and fail. The present types of enclosed fuses overcome most of the dangers of the older forms.

Unlined sockets and switches with too small current carrying parts are examples of poor design.

The cases of wrong use of materials and apparatus which come to the inspector's notice are numerous. Perhaps the most common are the use of undersized conductors and the overloading of switches.



Board From a Packing Box Set on Fire by a Lighted Incandescent Lamp Resting Upon It.

Poor workmanship is easy to find but hard to define. It is shown in defective joints, hazardous location of fuses and other apparatus and in poor wiring. The remedy for all these avoidable hazards is good material properly installed.

Inherent hazards are those which are inseparable from the normal operation of the apparatus. Such hazards are found in incandescent and arc lamps, rheostats, fuses, switches, etc. Of the total energy supplied to the ordinary carbon lamp only about 3 per

cent appears as light, the rest being in the form of heat. Examples of this sort of hazard are found in the installation of direct current motors in flour mills, woodworkers' shops and other locations exposed to dust. Rheostats and starters in similar locations are hazardous.

The hazard of fuses has been largely reduced by the use of the enclosed types. The gradual development of the fuse and fuse block from the original hazardous form has already been mentioned.

In this connection probably the most difficult thing to safeguard is the installation of the various forms of heating devices. A large proportion of real

Old Wooden Fittings. 1. Arc Switch. 2. Ceiling Rosette. 3. "Combination" Fixture. 4. Cut-out Fused with No. 14 Copper. 5. Small Cut-out. 6. Snap Switch. 7. Ceiling Switch. 8. Fuse Block.

electrical fires are from flat irons, chafing dishes and such utensils. It is an especially difficult matter to control since in most cases the device is portable and its location is left to the user who often has little idea of the possible dangers.

These inherent hazards must be taken care of in the design of fittings by providing for the dissipation of the heat necessarily produced by protecting the heated parts from possible contact with adjacent inflammable material.

Under this class of inherent hazards belong also those which are purely accidental such as the effects of lightning or stray high tension currents entering buildings. over lighting circuits. The reversal of polarity in direct current work, transformer breakdowns and the mechanical disturbance of wires all come under this head.

One other source of trouble which should be noted, although its discussion is beyond the scope of this paper, is the effect of electrolysis. Water pipes which have been corroded are likely to break down, thus crippling the supply of water for fire protection. Again cases are known where explosions and fires have resulted from corroded gas mains. In this connection also it is of interest to note the serious deterioration of steel used for re-enforcing concrete when subject to electrolytic action.

Another hazard usually classed as electrical and covered by the code is the moving picture machine. The real danger point here is in the highly inflammable film. The early types of machine with their open reels were very hazardous. Improved construction has reduced the danger materially.

Another important connection between electricity and the fire hazard is in the various forms of signalling systems. Municipal fire alarm systems, watchman's time recording clocks, auxiliary fire alarms, thermostats, sprinkler supervisory systems, etc., are made possible only by the use of electric circuits.

In conclusion just a few words about the National Electrical Code. These rules are based on experience rather than theory. Sometimes they may seem to be contradictory, as when it is insisted that wires must be carefully insulated from the wood of a building and are then permitted to be run in wooden moulding which is nailed to the same wooden building. The best answer to such objections is that the various requirements have proved to be satisfactory and necessary. Certain requirements may not have come within the observation of one man and he therefore does not see the need of them. It should be remembered that these rules are based on the experience of many persons in various parts of the country.

Mr. Woodbury in an address before the National Contractors' Association at Cleveland thus characterized the code:

"The National Electrical Code I believe to be a most remarkable concentration of scientific practice and the property and business interests which it represents are immense. It is, of course, well known that the rules have an anomalous standing; they are not law; they have no legal status; they have no fixed, defined force of authority to compel compliance or legal penalties for infraction, and yet, appealing to public sentiment and to the pertinent interests by the force of their own inherent virtue, they are strong and potent in their application to the design, installation and operation of electric plants."

A Letter to the President sent by the American Institute of Consulting Engineers directs attention to the importance of the appointment of some able and experienced engineer to fill one of the vacancies on the Interstate Commerce Commission, and the reasons for such an appointment. The Insterstate Railway Commission is charged not only with the regulation of transportation rates, but also with the regulation and inspection of safety appliances used in our railways, with the investigation of accidents and with the stupendous and expensive task of making a physical valuation of the railways of the country; consequently many of the duties of the commission are highly technical. It is argued that the leading part taken by the engineer in the construction and operation of railroads peculiarly adapt him without special training to be of invaluable service to the commission whether in connection with the regulation of rates, the investigation of accidents and the determination of proper safety devices, or the physical valuation of railways. Touching upon the tremendous value of the work of the commission to the community the Institute respectfully suggests that the Interstate Commerce Commission should, for the reasons stated and others, include in its membership one or more engineers. The Institute emphasizes its position. It has no candidate to offer and no motive except to serve the administration.

PUBLIC UTILITY ACCOUNTING IN OREGON.

Instructions Pertaining to Uniform System of Accounts for Electric, Gas, and Water Utilities.

(Continued.)

5. **Discount, Expenses and Premium on Funded Debt.**—Ledger accounts should be provided to cover the discounts, expenses, and premiums on each class of funded debt issued or assumed by the company. By "Discount" is meant the excess of par value of funded debt securities issued or assumed, and the accrued interests thereon, over the actual cash value of the consideration received for such security (except securities that have been sold and re-acquired). By "Premium" is meant the excess of the actual cash value of the consideration received for funded debt securities issued or assumed over the par value of such securities and the accrued interests thereon (except securities that have been sold and re-acquired). By "Expense" is meant all expenses in connection with the issue and sale of evidences of debt, such as fees for drafting and recording mortgages and trust deeds, cost of engraving and printing bonds, certificates of indebtedness, and other commercial paper having a life of more than one year; fees paid trustees provided for in mortgages and trust deeds; fees and commissions paid underwriters and brokers for marketing such evidences of debt, and other like expenses.

If the net balance in any of these accounts is a debit, there should be charged to account "Amortization of Debt Discount and Expense," during each fiscal period (and credited to the discount and premium accounts in which the discount and expense is carried), such proportion of the discount and expense on the outstanding funded debt obligations, as may be applicable to that period. This proportion should be determined according to a rule, the uniform application of which throughout the interval between the date of sale and the date of maturity will extinguish the discount and expense on the funded debt. The charge to income for any period should not exceed the proportion applicable to that period, and a charge should be made for each period so long as any portion of the discount and expense remains unextinguished. In order that the discount and expense may be extinguished sooner, the utility may, at its option, charge to Corporate Surplus or Deficit Account all or any portion of the discount and expense on funded debt, remaining at any time unextinguished.

If the net balance in any of these accounts is a credit, there should be credited to account "Release of Premium on Debt" during each fiscal period (and debited to the discount and Premium Account, in which the premium is carried) such proportion of the premium on outstanding funded debt obligation as may be applicable to that period.

These proportions should be determined according to a rule, the uniform application of which throughout the interval between the date of sale and the date of maturity of the debt will extinguish the premium at which such debt was sold.

If the net of the balances in the "discount and premium" accounts for all classes of funded debt sold or exchanged is a debit balance, the amount should be included in account "Unamortized Debt Discount and Expense"; if a credit balance, the amount should be included in account "Unextinguished Premium on Debt."

Except as provided in section 12, (Interest accruing during construction period), no discount and expense on funded debt should be charged to or included in any account as a part of the cost of acquiring any property, tangible or intangible or as a part of the cost of operation.

6. **Contingent Assets and Liabilities.**—Contingent assets and liabilities should not be included in the body of the balance sheet statement, but should be shown in detail in a supplementary statement accompanying the balance sheet. Contingent assets represent possible sources of value contingent upon the fulfillment of conditions regarded as uncertain. Contingent Liabilities include items which may, under certain conditions, become obligations of the utility but are neither direct nor assumed obligations on the date of the balance sheet.

7. **Income Account Defined.**—The income account brings together those accounts that show the total amount of money that the utility has received, or become entitled to receive for services rendered during a given period, the return accruing during the period upon investments and disbursements and obligations (fixed charges) incurred that affect the disposition of the amount so received or accrued.

The sum total of the credit balances in the operating revenue accounts at the close of a fiscal period, diminished by the operating expenses, the taxes and the uncollectible bills assignable to such operations, gives the operating income (or loss) for the period.

To the operating income (or loss) are added the non-operating revenues less the non-operating revenue deductions, which gives the gross income for the period.

From the gross income are deducted various compulsory deductions; this gives the net income (or loss) for the particular period. From the net income are deducted such appropriations as are made from income; this gives the amount that should be carried to the "Corporate Surplus or Deficit Account."

8. **Taxes.**—Separate accounts should be kept of the taxes applicable to operating and to non-operating revenues, and if the utility is engaged in more than one utility service or other business, taxes applicable to such other utility service or business should also be kept separate.

The tax accounts should be charged at the close of each month and account "Taxes Accrued" concurrently credited with a month's proportion of taxes applicable to the operation covered by each account. If the exact amounts of the annual taxes are not known, they should be estimated, and one-twelfth of the estimated amounts charged each month. From time to time during the year, as the actual tax levies become known, the monthly charges should be adjusted so as to include as nearly as may be possible the total amount of the taxes in the year to which they apply. When any such tax bill is paid account "Taxes Accrued" should be debited with the amount of the payment. If the balance in account "Taxes Accrued" is a debit balance due to the prepayment

of taxes applicable to a period subsequent to that for which the income statement is given, the amount of the debit balance should be shown in account "Prepaid Taxes"; and if the balance is a credit balance, the amount should be shown in account "Taxes Accrued."

Taxes on property leased should be charged to the appropriate tax account by the party which under the terms of the lease contract is obligated for such taxes. If the other party to the lease, as a matter of convenience, pays the taxes to the public authorities, such taxes should not enter into tax account.

The tax account must not include any fees or charges sometimes called taxes, such as water taxes, drainage taxes, fire taxes, etc., which are payments for some specified service rendered by the government.

9. **Corporate Surplus or Deficit Account Defined.**—This account or summary is the connecting link between the "Income" Account and the balance sheet. It summarizes the changes in the corporate surplus or deficit, during a given fiscal period, resulting from the operations and the business transactions during that period, as well as those effected by any disposition of net profit made solely at the option of the utility, by accounting adjustments not properly attributable to the period, or by miscellaneous losses or gains not provided for elsewhere. The Corporate Surplus or Deficit should be shown on the balance sheet statement under account "Corporate Deficit" or under account "Corporate Surplus Unappropriated."

10. **Fixed Capital Defined.**—By the fixed capital of a public utility (frequently termed the "Construction Account") is meant the property, both tangible and intangible, which is devoted to the accomplishments of the principal purposes of its business, and which has an expectation of life in service of more than one year from date of installation in service (exception being made in the case of hand tools and other small portable tools, that may be lost or stolen).

Fixed capital may be described as consisting of original capital, additions, betterments, and replacements, as defined below.

Original capital is the fixed capital installed or acquired prior to the beginning of regular operation by the utility. It includes the acquisition or construction of the plant necessary to begin the regular operation of its business. The cost of original capital should be charged to the appropriate sub-accounts under "Fixed Capital Installed prior to July 1, 1913," or under account "Fixed Capital Installed since June 30, 1913."

Additions are structures, facilities, equipment, and other properties added to those in service at the beginning of operations, and not taking the place of any property of like purpose previously held by the utility. The cost of additions should be charged to the appropriate sub-accounts under account "Fixed Capital Installed since June 30, 1913."

Betterments are mechanical changes in structures, facilities, or equipment which have as their primary aim and result the making of the properties affected more useful or of greater capacity than they were at the time of their installation or acquisition. The cost of such portion only of the changes incident to betterments as will, when added to the original cost of the property bettered, give the cost of replacement or reconstruction in present condition of the property as bettered should be charged to the appropriate sub-accounts under "Fixed Capital Installed since June 30, 1913." The remainder of the cost of the change should be classed as "Extraordinary Repairs" and be charged to the appropriate operating expense accounts.

Replacements are those installations or fixed capital which have for their purpose the substitution of one building, structure, pieces of equipment, or machinery for another which it has become necessary to retire, the substitute having substantially no greater capacity than the property replaced; also the extension of life period of franchises, patents, and other intangible fixed capital.

The cost of the fixed capital retired should be credited to the fixed capital accounts in which it is carried and the cost of the fixed capital installed in place of fixed capital so retired should be charged to the appropriate sub-accounts under "Fixed Capital Installed since June 30, 1913."

11. **Cost to Be Actual Money Costs.**—All charges made to fixed capital or other property accounts with respect to any property acquired on or after July 1, 1913, should be the actual money cost of the property. When the consideration actually given for anything with respect to which a charge is made to any fixed capital or other property account is anything other than money, the actual consideration should be described in the entry with sufficient fullness and particularity to identify it, and the account charged should be actual money value of such consideration at the time of the transaction.

12. **Interest Accruing During Construction Period.**—"Interest During Construction" should include only such proportions of the interest on funds used for construction purposes and of the discount and expense on funded debt as is equitably assignable to the period between the date of the issuance of securities and the time when the property acquired or the improvement made through such issuance becomes available for the service for which it is intended. The proportion of interest discount, and expense thus chargeable should be that which the period prior to the completion or coming into service of the facilities or improvements constructed bears to the entire life of the securities issued.

13. **Costs of Labor, Material and Supplies.**—The term cost as used in the fixed capital (or construction) account means the actual cost in money of labor and materials used in construction, or the actual cost in money of property acquired after construction, or if the consideration given is other than money, the actual money value of such other consideration at the time of the purchase. Cost of labor includes not only wages, salaries, and fees paid employes, but also the personal expenses of such employes when borne by the utility. Cost of material and supplies consumed in construction is the cost at the place where they enter into construction including cost of transportation and inspection when specifically assignable. If such materials and supplies are passed through storehouses, their cost entered in the account may include a suitable proportion of store expense.

[To be continued.]

INTEGRATING METERS IN EFFICIENCY TESTS.

BY C. S. HULL.

(In this article the author describes a method of measuring the output of turbo-generators during efficiency tests by the use of carefully calibrated watt-hour meters. Such a method is practically essential, due to the varying load conditions which obtain and which make it almost impossible to determine the average readings of indicating instruments over a long period of test. Mr. Hull is connected with the standardizing laboratory of General Electric Company at San Francisco.—The Editors.)

It is the usual practice in making efficiency tests of large steam turbines to run at constant load for three of four hours in order to make sure that all the operating conditions have become settled.

It is customary to measure the output of the turbo-generators by carefully calibrated portable watt-meters used in connection with current and potential transformers. If the load conditions are reasonably steady, this method is probably the most accurate. In most instances, however, the tests are made with the machine on the line, in which case the load conditions are continually varying. It then becomes at times almost impossible to accurately read the average indications of the instruments for a long time.

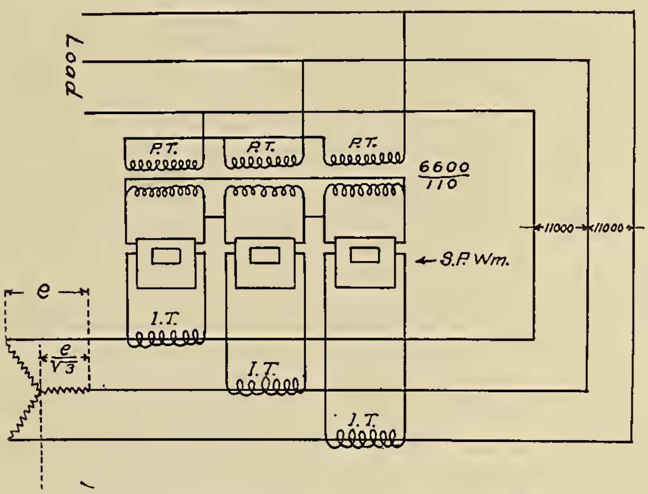


Diagram Showing Method of Using Three Meters and the Extra Transformers for Measuring the Output of Turbo-Generators in Efficiency Tests.

Realizing these conditions the General Electric Company has successfully used integrating watthour meters in several important tests. These meters are fitted with diamond jewels and dials which will record between three and four hundred times as fast as ordinarily, so that a good reading can be taken every ten or fifteen minutes. These meters are calibrated with their transformers and connected load as they will be used in the actual test, conditions being as nearly the same as it is possible to make them. In case it is impossible to check the meters with their transformers and no other transformers are available, the corrections for ratio and phase angle as furnished for the standard line of current and potential transformers are used. The corrections will always be found to be very close for transformers of like type. For more detailed information in regard to the method of determining these errors in transformers and applying necessary corrections, the reader is referred to a paper by Mr. L. T. Robinson, Proceedings A. I. E. E., June 30, 1909 Volume, which covers the subject in a most complete manner.

The question will naturally arise as to the proper number, type and scheme of connections of the meters to be used. In a straight 3-wire polyphase system either a polyphase or two single-phase meters will give correct results.

A polyphase meter has an advantage over two single-phase meters at low power factor. At 50 per cent power factor, assuming full volt-ampere load, a polyphase meter will run at one-half speed, whereas in the case of two single-phase meters, one of them will not run at all. Also below 50 per cent power factor, one of the single-phase meters will run backward. Here is a chance for a slight error due to the fact that the meters are compensated for friction for a forward rotation. These errors are all very small, but in accurate work must not be lost sight of.

The three meter method of measurement has several advantages. In the first place all will run at the same speed, regardless of power factor, each recording 1/3 of the output. In case of accident to one or even two of the meters, the other may be considered as having recorded 1/3 of the power. If the system is 4-wire, 3 phase, three meters are essential for accurate readings. The three-meter method of test requires (except when the station is already so wired), three extra potential transformers having a primary rating equal to 57.7 per cent of the line voltage. For tests on 11,000-volt systems, 6600-volt potential transformers are used. If a polyphase meter or two single-phase meters are used, the transformers in the station are generally available either by previously checking them or by taking their characteristic curves.

In considering the degree of accuracy which may be expected in a testing outfit made up of integrating meters, a variety of conditions must be considered. We correct for the controllable conditions. The uncontrollable include variations in temperature, power factor, and wave form due to load conditions. It is therefore safe to say that with the meters carefully standardized, an accuracy within one per centum may be expected, although often in practice much closer results are obtained. We have had on several occaions tests in which two single-phase, three single-phase and a polyphase meter were connected in the same circuit and checked each other within one-half per cent maximum variation on runs of four hours or more duration.

In the diagram is shown the method using the three meters and the extra transformers.

Natural gas consumption in the United States in 1912 was 562 billion cu. ft., at an average price of 15.04 cents per 1000. On the assumption that 28,000 cu. ft. of gas equals in heating power 1 ton of coal the fuel displaced last year was equivalent to 20 million tons of coal.

Through rates to all points on freight and passenger traffic will result from arrangements now being completed by the Pacific Electric Railway Company, Los Angeles. The local rate will be absorbed by the connecting road. The electric line thus becomes a feeder to the three transcontinental lines operating out of Southern California.

THE QUESTION OF ENGINEERING EDUCATION.

The following discussion of their views on the question of engineering education was recently submitted by the Oregon Society of Engineers to the president and members of the Board of Higher Curricula, State of Oregon:

The discussion is, as closely as possible, confined to the points brought up in your letter to the society, viz.: (A) Defining the terms "Professional Engineer" and "Industrial Engineer"; (B) Outlining courses for each that would give the minimum requirements to produce competent and safe engineers, yet not shut out the boy of limited means; (C) Showing how far the two courses would be similar and where they would differentiate.

The first question is well answered by quoting from the paper of William McClellan on "A Suggestion for the Engineering Profession," Proceedings of American Institute of Electrical Engineers, June, 1913, as follows

The engineer of today traces his ancestry along two distinct lines, one practical, the other theoretical. In times past what we call engineering was done either by a skilled mechanic or by a scientist having a practical bent. As the demand became more and more complex, and as science opened up wider and wider fields of knowledge, the mechanic became more and more skilled in certain ways, and some scientists became more and more practical. The merging of these formed a group of workers, having common aims and now known as engineers.

The skilled mechanic, however, from the standpoint of quantity, was by far the larger element. One need go back only to pioneer colonial days to learn that practically all of the engineering, as we know it, was done by the surveyor, the millwright, the master carpenter, the master mason, the smith and others. Even now many a smith claims to be able to forge without plans a hook equal to any that a mechanical engineer can design, and many a country carpenter will frame quite complex roofs of a variety of types, all "out of his head."

Passing quickly over many interesting details, we find that more or less on account of their industrial lineage engineers are divided into classes. Once there were two of these, civil and military. Later, starting with the multiplication of engines and machines, the civil class divided up into the almost innumerable varieties of engineers, which it is unnecessary to list here—if we could.

As a result, while there are many men of a great breadth of mind and experience worthy of the title of "engineer," there is no one who can claim it in the same way that lawyers and doctors can claim their titles. There are engineering professions, but there is no one profession. There are engineering degrees, but there is no one engineering degree. There is no engineer without an adjective. It must be acknowledged that there is some truth in the charge of "lack of breadth," considering the whole body of engineers. It is also curious that in medicine and law the students leave school with all the same general training and degree, but specialize afterwards, whereas in engineering they are specialists at school. So far as individual activity is concerned, engineers are of different types in same way that lawyers and doctors are, but to a greater degree of demarcation. Today all the numerous classes of engineers contain three distinct types of members:

First, the theoretical engineer, who in reality is not an engineer. He is, and it would be proper to call him, an applied scientist. Many of the engineers in our great electrical manufacturing companies are in this class.

Second, the mere manual and mental operative, the hewer of wood and drawer of water in the engineering world.

Third, the real engineer, who can design and create, who can adapt the resources of nature efficiently to the service of man.

In passing, it may be remarked that the presence of these three types in each class of engineers is the chief difficulty in arranging proper courses in engineering education.

Many will remember how often within the last few years a demonstration or recommendations by a united engineering profession would have been valuable. Society needs such help in connection with conservative discussion, appointments of the many municipal, state and national commissions involving engineering in some form, opposition to ill-advised or vicious laws, methods of conducting public work, and a variety of other similar matters. When unity is so desirable or even necessary, a great effort is worth while to obtain it, but the question is, how?

We might turn to the colleges or technical schools. I have suggested before, and long to see the time, that some prominent school shall offer the degree of Bachelor of Engineering, and give all such students the same general course with a very small percentage of special electives. The schools are moving in this direction, and we should have great faith in them. Of necessity the progress is slow, and will not answer immediate needs. If revolutionary changes were possible at once, the effect would not be seriously felt for years. The schoolmen must be given time to work out their plans. Outside engineers may occasionally offer valuable suggestions, but they are much less able to attack the problem than those whose business is to study it at close range.

By way of summary we will say that the professional engineer is one who is qualified by breadth of scientific and technical training, experience, executive ability and knowledge of economic questions, to conceive, design and carry into execution safely and economically, entire engineering projects; also by application of general scientific principles and knowledge gained by experience, to meet and solve unforeseen and unprecedented engineering problems and thus truly become a factor in the progress of civilization, in other words the third class of man referred to by Mr. McClellan in the above quotation.

The term "Industrial Engineer" as used by some of our members in oral discussion at your meeting of August 25th was meant to cover the second division referred to by Mr. McClellan. This term has not heretofore to our knowledge been used and in our opinion was not well chosen as the class of men which it was intended to describe should not properly be called engineers. They are properly in the class of skilled artisans, draftsmen, surveyors and others whose work requires considerable technical knowledge but is not of a truly professional character.

The term "engineer" is one very loosely used and applied to men requiring for their work a great difference in qualifications from that of the locomotive engineer, the steam shovel engineer and many other positions which do not rank higher than that of a mechanic, to the position of the truly professional engineer, where the highest degree of scientific and practical knowledge and ability is required.

It is questionable whether or not the term "engineer" should be applied to those having such a vast

range of qualifications. The question as to whether it would be best to classify the great mass of subordinate engineers by some other name or to designate in some new manner the small minority of engineers who have truly professional qualifications is one which must eventually come up for consideration if engineering is to reach the truly professional plane to which it is entitled, but is a question which we will not attempt to discuss at this time. Suffice it to say that relatively few engineers are required by their work to act in a truly professional capacity, whereas the majority occupy subordinate positions where a high degree of technical knowledge along some special line is required but where their value is chiefly represented by the amount of work accomplished and it was the latter class which was intended to have been defined by the term "Industrial Engineer."

The doctor performs the operation while the trained nurse attends. The nurse may be fully competent to perform many operations but his or her training has not been such that we are willing to impose this confidence in the nurse. Just so the professional engineer occupies a place to compare with the doctor and there has grown up a distinct class of engineers to compare with the trained nurse.

Outlining Courses.—In considering this matter it becomes necessary for us to discuss the four alternatives which are now being considered by your Board, viz:

1. Proceed practically as at present with some slight revision with a short course at the Agricultural College and a long course at the State University.
2. Parallel all courses in each of the two institutions.
3. Consolidate all engineering at the State University.
4. Consolidate all engineering at the Agricultural College, on account of mechanical equipment located there.

As throwing some light on the policy to be followed with reference to the above alternatives, it should be said that the practical training of the professional engineer should partake more of the nature of laboratory work in becoming thoroughly grounded in physical principles than that of actual shop practice, which is admirably suited to fit a man for the subordinate engineering positions. The professional mechanical engineer for example, should know what operations can be performed by modern shop equipment such as lathes, planers, etc., and to what accuracy this work can be done. He should also know the behavior of the various metals under conditions of use, but he need not necessarily become proficient in the actual operation of the machine lathe or any other shop equipment. It is true that such information is of some value to him, but the entire field of knowledge in mechanical engineering is too great for him to attempt to master it. He will devote his time to the determination of larger, more important and fundamental problems in the design of machinery and leave to the skilled draftsman the working out of mechanical details which require an intimate knowledge and experience in machine shop practice.

We have given the question of the four alternatives very careful consideration and have received from some of our members very valuable papers which we attach for your record. Out of our investigation we must strongly recommend that the first alternative of proceeding nearly as at present with a short course at Corvallis and a long course at Eugene be continued, with some slight modifications to be submitted in a subsequent paragraph. In our opinion, the excellent and large shop equipment at Corvallis is admirably suited to the training of the subordinate or, if you please, "Industrial" class of engineers. We do not believe there is now, or ever will be, a demand for two professional engineering schools in the same state and so closely adjacent to one another, educating men for the minority positions, whereas there will continue to be an increasing demand in this state for a technical school which will train a large number of students in an immediately practical way for subordinate positions in all branches of the engineering field.

It is also our opinion that the training of professional engineers should remain at the State University where shop work is sacrificed to some extent in favor of laboratory work and where the various co-ordinate studies are better suited to train the student in the broad way required for the professional field. What has been said of the professional engineer also applies to the professional architect.

Long Course.—We are training in this course professional engineers, at least men who may ultimately qualify, although a long period of their lives may be spent in work alongside of men trained in the short course. However, the experience in practical work is essential to develop a good engineer and on the basis of a proper fundamental training the long course man will ordinarily outstrip the short course man, and be properly qualified to take the lead in professional work.

That human factor ever present, that would in occasional cases make the trained nurse a better doctor than the professionally trained man whom he is assisting, will apply to engineering as well, but since we are not dealing with particular cases we must plan for the masses and assume that the particular cases will take care of themselves.

We have examined the courses of the best schools in the country including Cornell, Michigan University, Massachusetts Institute of Technology and University of Wisconsin. We find that there is no important difference in the work of each. These courses are the work of men like Dean Turneaure of Wisconsin and President McLaurin of Massachusetts Institute of Technology and many of whom have had a number of years of actual experience in engineering work before coming into the colleges.

General principles should be taught. Details may be learned in actual work after graduation. Psychology should be introduced early in the course. Logic, public speaking and debate should be a part of the professional engineer's training; also economics, political economy, money and banking, sociology, ethics, commercial law and business practice.

The professional engineer is usually the employer of other engineers in lesser capacities for handling the details, such as gathering and classifying data, making surveys, supervising construction and detail design. As a matter of fact, the man on detail design

may have more knowledge of his subject than the engineer whose specifications he is following. There should not be much specialization in the training for professional engineers. This can better be worked out after the man has found his life employment. One good point in having the professional engineer trained at the State University is the broadening influence of his associations with students of other professions and aims.

It is believed to be the experience of the technical schools that the strictly technical training required to fit a student for a truly professional capacity requires four full years of college work leaving no time for such subjects as economics, psychology, etc., mentioned above. Many technical schools are therefore advocating that their students take five years for graduation and incorporate in their course a considerable number of these broadening studies which are required for the professional engineer. With this in mind we would strongly recommend that the professional course at Eugene be made a five years course and would advocate that the professional degree of civil engineer, electrical engineer, etc., be not given even then at graduation, but only after a student can show evidence of one to three years practical experience in the engineering field after graduation and the presentation of a thesis based upon some practical work in which he has been engaged. Four years of high school work should be required for admission. At the end of four years of college work the Bachelor degree could be given.

Our recommendation as to the thoroughness of work to be taught presupposes a more liberal allotment of money for this purpose than has been available in the past.

Short Course.—We are training in this course specialists in some particular branch of engineering, men qualified to take up the routine work of surveyor, draftsman, estimator, superintendent of construction, structural designer, etc.

In fairness to this class of students the college entrance requirements should be two years and two years only of high school. At the end of four additional years these men should be graduated with a certificate of merit stating the particular work for which they are qualified, and not a bachelor degree as now given at Oregon Agricultural College.

It might seem that since the short course is designed to aid the poor boy to get into profitable work quickly, that we are restricting his chances by making him specialize, whereas the five-year student has a general education that would give him a wider field in the selection of employment after graduation. However, there is the element of chance to consider, since the professionally educated engineer has greater competition for his coveted place in the world and perhaps nine out of ten will have to content themselves with a position along side of the short course man, specializing on detail work. The positions requiring special work are far more numerous than positions filled by professional engineers; hence the short course man has a better opportunity of obtaining immediately profitable work than the long course man.

We do not believe that the professional engineering course should be based upon the minimum in the interest of the poor boy. We believe that the boy who has the native ability and energy to make a successful professional engineer even with a vast amount of training, will have the ability and energy to earn his expenses through his engineering course if necessary. Many of our best students in the engineering schools as well as in other schools, earn their entire expenses and are better citizens and better fitted for taking responsible positions for having done so.

We have not worked out the exact studies and the number of hours to be spent on each for either the long or short course, as this involves a vast amount of study and a detailed knowledge of how much work can be covered by a student in a given number of weeks, with which only the engineer in actual teaching work is familiar. This had best be left to the instructors in the University or Agricultural College or might be submitted to a committee of technical educators of wide experience such as Dean F. E. Turneaure, of the University of Wisconsin or President McLaurin of Massachusetts Institute of Technology.

We have, however, appended to this report some tentative courses of study worked out by individual members for your consideration.

Similarity and Divergence of Courses.—Since we have recommended the continuation of the long course at Eugene and the short course at Corvallis, the question as to how long these two classes of students could study together and when they should differentiate, is no longer pertinent. It should be said however, that even though these two courses were in the same school, a difference in preparatory training and in the thoroughness with which the subject should be mastered would make it difficult to conduct them in common except in the case of fundamental sciences such as mathematics.

Duplication in the Two Schools: We feel it necessary to make a few remarks upon the effects of our recommendation upon the duplication of apparatus, equipment and teaching force in the two institutions.

In this connection it must be remembered that for efficient classroom work the size of the class should be limited and the number of instructors to handle the classroom work would therefore be proportional to the number of students and no economy would be effected by combining the two courses in one school except perhaps in some saving in heads of departments. This saving however, would be to the disadvantage of the students as they would have less contact with the older and more experienced teachers.

As regards equipment it must be said that as nearly as we can learn, the equipment at both University and Agricultural College is nearly all in use continually and to the highest efficiency. In addition, as previously mentioned, the University training would tend to a minimum of actual shop practice in favor of an increase in laboratory work, thereby requiring somewhat the same general difference in equipment which now exists in the two institutions.

Respectfully submitted: W. S. Turner, L. F. Harza, W. H. Crawford, Henry Blood, H. L. Vorse, Special Committee, Oregon Society of Engineers.

Orrin E. Stanley, Secretary Oregon Society of Engineers.

LOAD-FACTOR BUILDING.

BY R. B. MATEER.

(The author who has specialized on the subject, gives an interesting resume of what is necessary for the building up of a good load-factor and its co-operative value as a business builder for all. This paper was presented by Mr. Mateer at a meeting of the San Francisco Electrical Development and Jovian League.—The Editors.)

Seeking a subject of mutual interest to dealer, contractor and public utility, it was suggested that perhaps an outline of the duties that have, for a number of years, characterized my share in the development of public utilities with reference to the methods productive of the best results and the value of such work to all engaged in the business growth of everything electrical might be of interest. Accordingly I tender a few remarks on load-factor building—scientific promotion of the sale of current with special reference to the filling up of the valleys of the load curve.

Not many years ago, every light and power company confined its attention to the marketing of current for illuminating purposes only. Then a few daring pioneers conceived the idea of a day circuit and the sale of a few motors to drive machinery in the shop. At a latter date electrical appliances were advocated. Each contibuted to the use of "juice" over longer periods of time and resulted in greater earnings to the utility with added profits to those interested in the sale and installation of current using appliances. Yet, up to a few years ago but little attention was given to the systematic development of those classes of business which would even up the load curve—the graphic illustration of the operating conditions of every utility. Salesmen are sent out to canvas in a more or less haphazard manner, the residence, shop or factory. Illumination generally occurring at periods of highest demand and resulting in a minimum of current used with a revenue of $1.00 per month per consumer is the result of such effort. Perhaps a motor of some 5 or 30 horsepower is signed up guaranteeing a monthly revenue of 5 or 30 dollars, according to the connected load, yet the actual current consumed may be only from 100 to 500 kilowatt hours per month and occurring at such times as either coincide with the lighting peak or aid to build up other peaks occurring in the morning or afternoon. But of what value is such a load that only assures a consumption of 3 or 4 per cent of the possible energy available for a period of twenty-four hours per day? You who are charged with the earning of dividends on the funds entrusted to your care by a confiding public may perhaps know what your load-curve looks like. Will it show only a small demand for current from midnight until 6 p. m. with occasional morning peaks as the machine shop motor is turned on; while from 6 p. m. the load rapidly increases until 8 o'clock when every available generating unit is turning out energy for the apparently insatiate needs of your customers. Yet within the hour the desire for service rapidly decreases and by ten o'clock it is only necessary to operate one of the several generating units while the greater portion of the investment lies idle. Or perhaps by reaching out for business, industrial load is secured and a good output in kilowatt-hours is assured from 8 a. m. until 10 p. m., after which it is necessary to operate only the smallest units to supply the intermittent, standby service.

Conditions above outlined are descriptive of many of the load-curves of the quasi public utilities throughout the country. Each is startling evidence of the need for a comprehensive study of the customer's requirements; of a failure to analyze the territory served, together with a lack of appreciation of scientific methods of commercializing electric service by advocating current using devices and at such times as will assure the operation at maximum load of 70 per cent or more, of the total generating machinery installed.

Load-factor building—the development of an operating curve showing a continued demand for service at or near the full rated capacity of the generating station and for a 24 hour day or a year of 8760 hours is not a dream but a reality when aggressive means are used to fill up the valleys of the daily load curve and incidentally when contentment with present results ceases to be a virtue.

Methods—Of all the schemes for building a good load-factor those most essential to success are: a knowledge of the territory supplied with service; a knowledge of the customer's needs; familiarity with the service requirements of modern electrical appliances; the development by solicitation, advertising and demonstration of confidence in appliances and their use by a consuming public; the upkeep of a broad and up-to-date system of records showing the location of every appliance on the system; the opportunity for additional educational effort and the marketing of other "juice" using apparatus; an aggressive organization consisting of active district agents alive to the opportunities for business and operating under the direction of an up-to-date commercial agent, not drafted from other fields of labor but trained along the lines of central station activities. And last but not least co-operation between dealer, contractor, consumer and utility. Passing over all discussion on the above methods, here given as a result of a number of years in the field, permit me to present a few of the "fifty-seven varieties," or rather, to be exact, four hundred and sixty actual uses for electric service that are employed to a limited degree or fail to receive the support of the central station and dealer in their pursuit for profits, illustrating also, how they may be so dovetailed that the utility will present a load curve without a valley and with only a barely perceptible peak.

The residence—For the residence, the general use of the electric range, in service daily four out of every 24 hours; the toaster, percolator or chafing dish in use one out of every twenty-four hours, the washing machine and mangle six hours each week and with the iron showing on the Monday and Tuesday charts a very noticeable increase in day load; the vacuum cleaner with eight hours' service each week all contribute to the use of current where most desired. Again for the hot weather the fan, and for chilly days the electric heater, generally a day load, but aiding in the evening hours to reduce the lighting peak by the use of current over a period of several hours' duration, are useful in load-factor building. The average residence curve would show a demand for current, varying according to seasons of from fifteen hun-

dred to twenty-five hundred watts from 6:30 to 7:30 a. m. with a demand of 500 watts continuing at least one day of the week until 11:30 a. m., then a demand of 1,000 watts until 12:30 with from 100 to 750 watts at least one day of the week until 4:30. From 4:30 until 6:30 p. m., 750 watts is required until illumination is needed; when from 300 to 500 watts for a few hours are recorded on the meter. Largely a day load and sought by lighting companies—if aggressive.

The shop—For shop and mercantile establishment little current is demanded except at or near closing hours, which is so largely responsible for the poor load-factor of such business. To broaden out the peak—display lighting sign or window illumination from dusk until midnight is sought, giving a load-curve showing little or no consumption until 6 p. m., then a peak of short duration, and a continued pull on the lines by reason of the use of decorative lighting and electrical advertising until midnight.

Industrial—For mill and factory, driving line shafts, operating long lines of machinery or for individual operation of a particular machine, motors are installed and result in a fair demand for service from usually 8 a. m. until 12 and from 1 until 5 p. m.

Peaks usually in the morning are characteristic of such loads, which still give us a noticeable valley in the curve. How to remedy a condition such as the three load curves super-imposed one on the other will show, is a problem ignored by many, considered by some and solved by a few.

Special attention is directed to equipping the home with and encouraging the use of every electrical appliance, small as well as large. Flat rate schedules or automatically controlled circuits coupled with aggressive development of long hour display lighting reduces perceptibly the night peak. Educational work in outlying districts develops a pumping load stretching over the morning hours from midnight and until 4 p. m. the succeeding afternoon. Dairy and creamery—electric milking, cream separating and refrigeration, demand current from midnight and until at least five in the morning. Vehicle charging requires service from 10 p. m. until 6 a. m. with a peak usually at 2 a. m. These and other applications of electric service, at periods when markets are most desired are the result of a study of the load curve, not merely the ambition to sell current indiscriminately. I might continue at some length, treating on the load-factor of a combined system and the value of developing a pumping and agricultural load in one district; an industrial in another; display features in all business centers and seashore resorts, that the curve of each district super-imposed on the other might show a uniformly even demand on the entire system of 70 per cent and better, but many ask where does the dealer and contractor come into the game of load-factor building?

No appliance can be marketed without the dealer reaping his profit. The aggregate profits must largely hinge upon the utility and its aggressiveness in developing a territory and its co-operating with the dealer in live appropriate displays; advertising and marketing by seasonable campaigns his current using apparatus. No dealer can rest on his oars and have utilities when progressive, drag him along. Where the public utility inaugurates a campaign, the dealer should supply the stock and bear his proportionate share of advertising, leaving to the utility the charges incident to management rental, illumination and appliance sales business creation, or missionary work.

A co-operative game is load-factor building, with much of the profit on appliances going to the dealer, the lighting and power corporation profiting on the increased market for current, resulting in a good load-factor and the tucking away of some "velvet."

For the contractor, load-factor building results inevitably in greatly increased business. Where ranges and heaters are installed heavier feeds are essential; all power driven apparatus, motors, compensators, relays, etc., must be wired; vehicle charging demands expert attention for batteries; new buildings in city and in country must be wired as to pass inspection; supplies must be delivered electrically. Each resulting in profit to the contractor.

It may be stated in closing that while it is up to the utility to supply the funds, load-factor building is successful only when co-operation is accorded the commercial agent in charge of such development, by the contractor, dealer and staff. When grasping the opportunity to develop a satisfactory load-factor it should be remembered that results are attained only by the use of an aggressive business campaign inaugurated and continued by live harmonious management. Time prevents my quoting data as to load-factor of various apparatus used in building up ideal operating conditions for utilities, yet I unhesitatingly state that under a policy as here briefly outlined, a load-factor is excess of fifty and frequently of seventy per cent is possible.

INTERNATIONAL ELECTRICAL CONGRESS.

The International Electrical Congress is to be held in San Francisco during the week beginning September 13, 1915. It is one of a group of meetings, as follows:

Week beginning September 6th, International Electrotechnical Commission.

September 13th, International Electrical Congress.

September 20th, International Engineering Congress.

September 27th, International Gas Congress.

October 4th, American Electric Railway Association.

The congress program has been divided by the executive committee into twelve sections. Arrangements have been made with the Panama-Pacific International Exposition Company for the reservation of a main auditorium and several meeting rooms in the auditorium (now building) at the civic center in San Francisco. Attemps to reserve rooms for delegates in hotels of San Francisco so far have not been successful, due to reluctance of hotel managements to commit themselves. Preliminary work of an informal nature has been done by Dr. Kennelly and Mr. Mailloux looking to the securing of notable papers for the congress. In addition, Dr. Kennelly is now engaged in issuing about 125 letters to distinguished electrical engineers asking their suggestions of topics which should be discussed before the congress and of authors who should be invited to contribute.

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POWER AND GAS

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NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advrtisers should mail copy at least thirty days in advance of date of issue.

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CONTENTS

EDITORIAL NOTE.

As last week's editorial on "Western Distributing Warehouses" is susceptible of misinterpretation, the management of this journal wishes to correct any wrong impression which may have been unintentionally created. Its publication was inadvertent, and its policy is not endorsed.

A Merry Christmas

Christmas and the bells—the one suggestive of the other. List! From out the past memories almost audible recall the clear notes of the bells as they rang out merrily across the crisp air. They were the same bells which we heard always, but on this day they seemed different as they conveyed to we little children and those of larger growth, their message of a Merry Christmas.

Inharmony is unknown to the true note of the bell. Cling! And out across the county's side it carries its cheering message. Clang! Out again in never ending circles of sound until it reaches the remote hovel with its message of happiness to the humble dwellers. Giving always giving and so symbolizing the season of gifts. Cling! Reluctantly almost it ceases, but it will vibrate always is memory to make us glad.

Surely at this season of peace on earth to all men of good will, the selfish and sordid ends sought may be silenced and the finer sentiments catch the sweetness of the sounds which the harmony of life holds stored for us.

Now if ever we may be willing to give in that unselfish spirit which calls for no reward but that which results from the pleasure of giving—which gives that others may obtain happiness.

So the Journal sends out to its readers in a spirit of good-will this sincere wish for your happiness at this season, just as it would eddy out from the bell, and with the hope that it will find echo always in a myriad hearts that are glad.

A Merry Christmas.

The Glare of the Streets

The "glare of the streets" is at this season of the year a common expression. It indicates, however, an undesirable condition, for glare should be avoided always. Where for the time being an accepted old-fashioned system countenances, or again, where unskilled application of modern lighting units emphasizes it, early steps should be taken toward its elimination. Street lighting systems with all the wonderful improvements now employed are, in this respect, still far from perfect. Automobile, street-car and interurban car headlights, still pierce the darkness as a positive danger. Glaring store window lighting destroys our confidence in the merchant who uses it. Certainly the glare of the streets is undesirable.

Where street lamps are of greater brilliance than surrounding objects and installed at too low heights

above the sidewalks, they destroy their purpose by decreasing the ability of the eye to see. The great brilliancy of headlights temporarily destroys the visual function, besides being hurtful. It is at such times that the false step is made and an accident results. In store window lighting, inability to see clearly results from improper installation—a blinding effect produced rather than an illumination of the goods.

Comparatively but a few years ago it was then positively dangerous to walk abroad at night, and street lighting had its inception in an endeavor to minimize this danger. But in overcoming the dangers then existing, the pendulum has swung far over, and in the present day practice the danger lies in the lighting appliance wrongfully used.

When street lighting electrically was first considered the inventor had in mind the erection of a high tower and the use of a high-power source which would diffuse a light over all the city.

With the increased efficiency and the consequent increased intrinsic brilliancy of present-day lamps, it would appear that the present system of low mounting heights will become still more unsatisfactory and greater mounting heights be again sought. Perhaps some new method of indirect illumination of streets will be developed, for such an ideal contains untold possibilities. Its realization would do much toward removing that which is now undesirable in street lighting.

In considering this subject one fact stands out patent: That if the streets are well lighted, vehicle headlights are not necessary; that on well-lighted streets these headlights should be dimmed or altogether extinguished, or else be replaced with low candlepower sidelights. Accidents innumerable have resulted from the use of these powerful headlights. Not only have pedestrians suffered, but the drivers of the cars themselves become confused both by the brilliant light from approaching cars and in automobiles and from light also reflected in the wind shield by cars coming up from behind. It would be in the interests of all to have their selfish and inconsiderate use abolished.

For the glareless lighting of store windows reliance must be had on the honesty of purpose both of merchant and contractor. But an aroused public opinion insistently demanding all these improvements will be the surest method of effecting their complete accomplishment. The glare of the streets must go.

Engineering Education

This is the age practical in which that man is considered best educated who is most useful. The standard by which present day education is measured is utility. The industrial power and commercial standing of a nation—the community greatness—is an expression of the efficiency of its people.

Forms of civilization change, the essentials of those past but a consideration in those now existing. Now is emphasized the importance of industry, trade and commerce. Efficiency dominates these, and into all activities the work and counsel of the engineer has found its welcome and necessary place. The engineer of to-day is a product of the age practical.

But the term "engineer" has become too broad in its application to express properly the highest standing of that profession, for from the man who runs an engine, on past those who make it, then to those who design it, and up to the originator and discoverer of its principles, all are called by the same name. In other departments of engineering and its allied occupations, the same looseness exists. It is as though the pathfinder who discovered or determined the road, the men who made and those who traverse it, should all be called "pioneers."

Generalization in discussing engineering education is difficult unless it is limited to the education of those who will later be professional engineers of the highest order—"real engineers who will discover and determine and otherwise adapt the resources of nature to the efficient service of man."

Education of whatever kind is not that which is imparted to a man, but is a measure of the efficiency which he evidences.

The aim of engineering education should be efficiency; the providing of exceptional skill and knowledge and the faculty for complete and easy accomplishment.

The ramifications of engineering activities are complex and the requirements of engineering education therefore diverse. Engineering education should, however, constitute a cause which, properly applied, must result in right action. It should be founded on the fact that the engineer must be well-grounded in fundamentals. Physical principles, and principles of economics, psychology, logic, money and banking, sociology, ethics, commercial law and business, are among those considered essential. In addition, he must have initiative, pluck, perseverence and poise and self reliance.

Let a man be firmly principled in his profession and he will succeed ever, be the problem never so complex.

A further report of the Oregon Society of Engineers made to the President and Members of the Board of Higher Curricula of that State upon this subject of engineering education appears in this issue. It is impossible for such a discussion to be provincial, for it is of national importance, for engineering education has to do with those individuals through whom perhaps more than any others the community greatness of the nation is realized.

The pages of experience from the practical field should prove an invaluable aid to educational boards and commissions in establishing courses which loyally and intelligently prosecuted, will produce men so equipped as to be most useful to the engineering profession.

The college professor and educationalist from whom the final solution of this problem of determining the most efficient method of engineering education must come has also much valuable information to contribute. A nation-wide discussion, aided and coordinated by a central authority such as the Society for the Promotion of Engineering Education, would aid in simplifying this problem, the satisfactory solution of which would make for a further increased individual efficiency and consequent national supremacy.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

J. D. Hanna, manager Cleveland Car Company, is at Salt Lake City.

G. Douglas Jones, electrical engineer, state of California, is at San Francisco.

H. R. Noack, president Pierson, Roeding Company, was at Los Angeles during the past week.

J. H. Newlin, purchasing agent San Joaquin Light & Power Company, is at San Francisco.

W. Arnstein, president Oakland, Antioch & Eastern Railroad, has returned from an Eastern trip.

Wm. Henning, superintendent Desert Water Power Company, Kingman, Arizona, is at San Francisco.

H. C. Goldrick, Pacific Coast manager Kellogg Switchboard & Supply Company, is at Los Angeles.

Robert E. Wirsching has been appointed to the Board of Public Utilities, Los Angeles, to succeed **O. O. McReynolds**,

S. C. Lindsay has been elected chairman of the Seattle section American Institute of Electrical Engineers and **E. A. Loew**, secretary.

T. E. Bibbins, Jas. G. Pomeroy, H. E. Sanderson and **Miles F. Steel** have just been appointed Statesmen-at-Large of the Jovian Order.

Hal Lauritzen, Holophane Works of General Electric Company, San Francisco, is away on a business trip to Salt Lake City and Denver.

W. E. Dunn, director Los Angeles Railways, has been elected president of the corporation until the return of **H. E. Huntington** to Los Angeles.

Sidney Sprout, general superintendent and **O. G. Steele**, superintendent Siskiyou district California-Oregon Power Company, were at San Francisco last week.

Henry H. Sinclair, vice-president, Centerville Improvement Company, Los Angeles, has been transferred to the grade of member of the American Institute of Electrical Engineers.

John Salberg, salesman in the Denver office of the Westinghouse Electric and Manufacturing Company, returned to Salt Lake City last week on account of the heavy snows which prevented him from getting into Denver.

J. Paulding Edwards, consulting engineer, Sacramento, Cal., and **E. F. Scattergood**, chief electrical engineer, Bureau of Los Angeles Aqueduct Power, Los Angeles, Cal., have been transferred to the grade of Fellow of the Institute, A. I. E. E.

Frederic S. Burroughs, chief engineer, Public Service Commission of Washington, Olympia, Wash., and **Max Hebgen**, vice-president and general manager Montana Power Company, Butte, Mont., were elected members of the American Institute of Electrical Engineers.

T. T. Richards has been appointed assistant sales manager of the Wagner Electric Manufacturing Company, St. Louis. Mr. Richards has been associated with the Wagner Companys sales department for nine years, specializing in the marketing of the new devices produced by this company.

C. B. Vorce, construction engineer British Columbia Electric Railway Company, has completed a three years contract with that company and expects to leave shortly for San Francisco. The record of his accomplishments during the contract period is splendid and have been favorably commented upon by visiting engineers.

H. B. Miller, Thomas C. Burke, Professor F. G. Young, of the University of Oregon, are members of the Oregon Hydroelectric Commission together with **Professor T. A. H. Teeter** of the Oregon Agricultural College; **J. F. Watt** of Hood River; **W. H. Graves**, president of the Oregon Society of Engineers; **J. V. Tallman** of Pendleton; **H. L. Vorse** of Portland; **John McCourt** of Portland; **William Hanley** of Burns; **C. A. Park** of Salem; **T. H. Burchard**, president of the Oregon Federation of Labor; **Mrs. Clara Waldo**, of Macleay; **W. D. Dodson** of the Chamber of Commerce, and a representative from the State Grange to be appointed.

Richard M. Boykin, Washington-Oregon Corporation, Portland, Ore.; **Robert K. Buzzell**, Hobson & Gillies, Vancouver, B. C.; **Wm. Hockley**, industrial engineer Western Canada Power Company, Vancouver, B. C.; **Sidney W. Huson**, electrician Hobson & Gillies, Vancouver, B. C.; **Wm. F. Kelly**, district manager Canadian Tungsten Lamp Company, Ltd., Vancouver, B. C.; **Geo. F. Kenyon**, electrical engineer Hobson & Gillies, Vanvouver, B. C.; **Walter Langdon-Davies**, electrical engineer, B. C. Electric Railway Company, Ltd., Vancouver, B. C.; **Sherwood C. Lindsay**, electrical engineer, Seattle Electric Company, Seattle, Wash.; **Ralph Waldo McNeill**, electrician, Utah Copper Company, Garfield, Utah; **Frank G. Milligan**, operating engineer, Seattle, Wash., and **William J. Murphy**, chief electrical inspector, Edmonton, Alta, have all been elected Associate Members of the American Institute Electrical Engineers.

MEETING NOTICES.

Seattle Section A. I. E. E.

The December meeting of the Seattle Section was held on Tuesday evening, December 16th, in the Chamber of Commerce, Central Building. Mr. John R. King of the Puget Sound Traction, Light & Power Company, presented a paper on electrically driven vehicles, the discussion of which was participated in by several men engaged in the vehicle business.

At the November meeting, report of which was delayed, Mr. L. C. Lindsay read a paper entitled "The Use of Protective Relays on Power Systems."

Oregon Electrical Contractors' Association.

The Oregon Electrical Contractors' Association held its regular meeting at the Commercial Club at 6:30 o'clock Wednesday evening, December 10th, when much time was devoted to the discussion of the new bookkeeping system being compiled by the National Electrical Contractors' Association.

Jovian Electrical League of Southern California.

The regular meeting was held at Christopher's Los Angeles, on December 17th. The chairman of the day was Mr. Carl Johnson. An address on "One of Los Angeles' Greatest Needs," was read by Mr. Volney S. Beardsley. The meeting was adjourned on account of the holiday season, to meet again on January 7, 1914. Many applications have been received for the Jovian Rejuvenation to be held in January which it is expected will be a record-breaker.

Oregon Society of Engineers.

On Thursday evening, December 11th, the Oregon Society of Engineers held a regular meeting at the Public Library Building, Portland, Oregon. Mr. Robert S. Edwards was to have given an illustrated talk on "Concrete Roads," but on account of his unavoidable absence from the city this was postponed and instead, Dr. Lazell gave an interesting talk on "The Manufacture of Portland Cement," followed by Mr. Ralph Modjeski who gave a short description of the new bridge he designed and which is now being constructed across the St. Lawrence River at Quebec, Canada.

California-Oregon Electric Power Company's Club.

The California-Oregon Power Company Electric Club meeting was held in the club rooms, Electric Building, Med-

ford, Oregon, on the evening of December 12th. The subject discussed was "Warehouse and Supply Business," and short papers were contributed by H. L. Walker, Sidney Sprout, G. B. Conwell, O. G. Steele, O. O. Alendorfer, J. D. Linnott, R. R. Ebel, F. O. Shason, J. J. Buchter, J. M. Chamberlain, H. C. Stoddard, E. G. Henselman, Don Colvig, C. L. Clevenger, F. F. Loder and C. A. Malone. A dinner in keeping with the holiday season was also served.

Utah Electric Club.

The regular weekly luncheon of the Utah Electric Club was held in conjunction with the Commercial Club, the Manufacturers' Association, the Native Sons, the Associated Ladies' Clubs, and other civic organizations of Salt Lake City, in observance of Utah Products Day, December 10th. Lon J. Haddock, of the Extension Department of the Agricultural College, was the principal speaker, and pointed out the economic advantages to all of the commercial interests of the state to use "home-made" products when they are available. The Electric Club had installed a sign over the tables which had been reserved in the main dining room of the Commercial Club for it, with the words, "Utah Electric Club," outlined in incandescent lamps. The club was congratulated by the various organizations present for its enterprise in providing such a novel feature for the occasion. It was announced that the first annual ball of the Club will be held at the Odeon Dancing Academy, Friday, December 19th.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The railroad commission rendered a decision granting authority to the Spring Valley Water Company to issue $1,000,000 of notes for the purpose of liquidating indebtedness and for carrying on work on Calaveras Dam.

The Pacific Light & Power Corporation applied for authority to issue $1,730,000 of bonds. The proceeds are desired for sinking fund payments and the refunding of indebtedness.

A decision was rendered granting authority to the Mt. Whitney Power & Electric Company to issue $250,000 of bonds.

A decision was rendered granting authority to Griffin's Transfer & Storage Company of Los Angeles, to issue $72,000 of stock and $50,000 of bonds for new equipment.

The Winters Gas Company was granted authority to issue $21,300 of stock for the purpose of building a gas plant in Winters, Yolo county.

A revised and reduced schedule of freight rates was put into effect in the Sacramento Valley on the Southern Pacific Company.

NEWS OF THE RAILROAD COMMISSION OF OREGON.

Four other physical connection cases between unrelated telephone companies have been decided by the commission and in each of these there were points of differentiation.

In the case of the First National Bank of Albany, Oregon, et al., against the Pacific Telephone & Telegraph Company, the bank sought to secure connection of its private intercommunicating system with the defendant company. The commission declined to order this connection, finding that as the bank is not a public utility it does not come within the purview of the law.

In the case of Henry Chappelle, owner of a telephone exchange in the city of Woodburn, Ore., against the United Telephone Company, which operates exchanges at Hubbard and Woodburn, the commission found that public convenience would be served by interchange of business between the plaintiff's exchange and the defendant's exchange at Hubbard, and directed such connection to be made, each company to pay the other five cents on each call originating on its line and carried over the other's lines.

Finding that the territory served by the Chehalem Mutual Telephone Company and the Newberg Telephone Company is substantially the same, and that active competition exists between them, the commission refused to order a connection on the complaint of the company first named, holding that no public necessity exists for such interchange. This is without prejudice to future complaint if the Newberg company fails to adequately supply the territory.

Dismissal of the complaint was ordered in the case of the Plainview Telephone Company against the Pioneer Mutual Telephone Company, the commission finding that the plaintiff's property consists of a number of rural telephone lines that do not come within the definition of a public utility.

TRADE NOTES.

General circulation seems to have been given a report that Ray D. Lillibridge, New York, will give up his advertising business and take up exclusively the exploitation of some California interests. Mr. Lillibridge states that this is not the case and continues: "It is true that we contemplate opening an office in San Francisco next year to take care of the interests of some of our clients in anticipation of and through the Panama-Pacific Exposition, but we have no idea whatever of abandoning our present location nor of making it subordinate to the new one."

A fire in the building at Second and Howard streets, on December 15th occasioned some inconvenience to the Exide depot and storeroom of the Electric Storage Battery Company and the warerooms of the Benjamin Electric Manufacturing Company, both of whose business offices are in the Rialto Building. The battery company has rehabilitated its former quarters and announces that but slight delay will be caused in filling orders, while the Benjamin Company has secured temporary ware rooms in the Telephone & Electric Company Building at New Montgomery and Howard streets.

NEW CATALOGUES.

The Lighting Studios Company, New York, has issued a serviceable catalogue in loose-leaf form listing their unique lines of illuminating glassware.

Data on Brookfield Insulators is being mailed by the Brookfield Glass Company, New York. The mailing card also contains a postal which will bring their complete catalogue No. 51 on request.

Sprague Electric Works of General Electric Company, New York, have issued Bulletin No. 247 describing in detail their round type motors and their application. Complete data is given and many uses illustrated.

Electric Household Appliances for Cooking and Miscellaneous Purposes is the title of a seasonable bulletin issued by the Simplex Electric Heating Company, Cambridge, Mass.

The Wagner Electric Manufacturing Company, St. Louis, is mailing a miniature reproduction of their Single-Phase Converter Bulletin No. 103. This brings it into more convenient size for the pocket, is convenient for mailing and advantageous to the man on the road.

Economical Steam Production is the title of a bulletin issued by G. L. Simonds & Co., Chicago, Ill. It deals with the elimination of soot and the resulting plant economies. Complete information is given, but provision is also made for those desiring still more specific data.

The General Electric Company's Bulletin A4131 describes Storage Battery Locomotives. The bulletin outlines the general conditions under which the use of such locomotives are desirable or advantageous, and illustrates and describes various devices and sizes which have been built and placed in service. The bulletin is accompanied by a data sheet for the use of those who wish further information.

PACIFIC COAST GAS ASSOCIATION.

(The following discussions are abstracted from the proceedings of the Pacific Coast Gas Association, 1913. The subheads are the names of the papers discussed, all of which have appeared in previous issues of this journal.—The Editors.)

Gas Company's Public Policy.

H. F. Keyes:—The trouble, as my experience in Sacramento for all these years shows, has not been altogether the public. I will give you one instance to demonstrate. Our wonderful city commission under our form of government made up their minds that they had to do something for the dear people, and they advertised that they were going to make rates on a certain day. They are supposed under our charter to make the rate in February, but there was going to be an election on the 15th of May, I think it was, and about the 8th of May they made up their minds that they had to reduce the rate. They advertised in both papers that the public was invited to appear at this meeting for making the rates, together with the representatives of the different corporations that were there, and register any complaints that they might have. I attended that meeting and how many of the dear public do you suppose was there? Not a single soul to make a complaint. But on top of that our commissioner of public works informed me that they had to do something. First he figured that he would make our rate 75 cents instead of a dollar. He spoke to one prominent member of the state railroad commission. In the meantime the state railroad commission had their expert to go over our accounts, and knew perfectly what we were doing, and they told him it was impossible. Then he said, "Well, we will make it 90 cents," and this member of the railroad commission says it would not be worth the paper it is written on. But they had to do something, and so they made the rate 95 cents and necessitated us to go to the United States Court to protect ourselves and put us to a great expense. I said to the gentleman when we tried to get them to rescind this ordinance, "I will ask you one fair question. All I want to know is what figures you used in determining the rates you have made for us in Sacramento." They did not say anything, except one of them turned around and said, "We just thought you were making money enough." He did not take the time to examine our annual report. It was politics and it is politics in nearly every instance, and you find that notwithstanding the public are absolutely satisfied, these officers think they must do something to hold their offices. I think you will find that obtains in nearly every city. It does in Los Angeles to a great extent and I think where the managers and the trouble men, as the gentlemen from Fresno said, go out and mix with the people as we have always tried to do in my corporation, you will find that your troubles will be very small. It will never do to say, "To Hell with the public," and if the different people that have the management of the different companies will get out as this gentleman says and mix with the people, you will do more to pay dividends to your stockholders than anything else.

Modern Gas Distribution and the Part Played by the Automobile.

D. E. Keppelman:—There are no limitations to the welding game. We weld about everything made of steel. This is an elegant opportunity to bring out the old conditions of welding and what we are learning today. We started with the generator on the ground. This has been entirely eliminated and we are now using a cylinder gotten out by the commercial acetylene people. You can get any size tank you want, from 100 ft. to 500 ft., costing you 2 cents a foot. Generated on the ground it would cost you approximately 1 cent a foot; but with generating you can't move the generator each and every time that you weld. It necessitates the running of half or three-quarter inch pipe for several hundred feet, with a great loss of gas, together with the troubles and difficulties experienced in moving the generator. We find that the commercial acetylene gas in tanks at 2 cents a foot is a great deal more economical.

In conjunction with what Mr. Leon Jones told you that we were doing with distributors, the hole is burned into the pipe with the same torch that does the welding. On 6 or 8-inch pipe that would probably take you from 20 to 30 minutes to cut with a cutter. It is done in 2 or 3 minutes with a torch and it is cut perfectly. The welded joint on 8-inch pipe, labor and material, which includes acetylene and oxygen and the labor of welding and handling the pipe and throwing it in the ditch, and lining it up and testing and so forth, is done today at 83½ cents a joint, a saving of more than a dollar on each and every joint, and that is only covering the initial installation. The cost of the outfit—we have used two kinds of torches. The first torch was a very good torch. It was a German patent. The regulation of the oxygen and acetylene was done with merely one arrangement—one control. That we found to be a very good torch for a beginner in getting his welded joints tight. After a while, when we became a little more experienced we found that the torch that had two controls, one on both the gas and the acetylene, was more economical, because we got a better mixture, saving considerably on both the acetylene and the oxygen. The cost of the torch is approximately $35. The rubber tubing necessary, two lengths of 50 ft. each, about 9 cents a foot. The acetylene cylinder we use is the 500 ft. size, which will cost you approximately $136, including the freight to San Francisco, The oxygen tank of 100 ft. capacity, which is all you will require, is $130. Oxygen today will cost you 2½ cents a foot. It is well and safe to figure at all times, with our practice today, a proportion of 1¼ of oxygen to 1 part of acetylene. The gauges necessary to cut down the pressure on your tanks range from 250 to 300 pounds down to a working pressure of 16 pounds on your oxygen and 4 pounds on your acetylene, and is approximately $25 a gauge. That includes all of your outlay.

The joints were given out by contract on our first installation and they wanted $5 a joint. We finally got it at $4 and later at $2.50 a joint. That same joint, 8 inches, which cost $2.50 under contract, we are doing today with our own man who is paid $3.75 for 8 hours, at 83½ cents a joint, including labor, material and so forth. Oftentimes the pipe is pitted, which will cover your electrolysis case, and that is about the easiest thing we do. The holes 2 inches in diameter in small pipe which would almost take out the arc of the pipe is covered up completely. That would take in the same work where we burn a hole in the pipe and insert a socket, practically building a boss on the pipe. I don't know of any case where we have had to build up a hole larger than 2 inches. We have made an experiment wherein we had 150 pounds pressure on the line, on testing, and we found a leak. As an experiment we endeavored to weld with the pressure on. It can't be done. The pressure when released enlarged the hole to about 2 inches. That was very nicely filled up and after the second test it was perfectly tight.

[To be continued.]

INDUSTRIAL

WESTERN WATER COMPANY PUMPING PLANTS.

Prompted by the urgent need of the oil fields, a corporation was organized to supply water for boiler, drilling and domestic purposes to the largest oil field in the world, known as the "Midway." This field was at that time being supplied with boiler and drilling water from deep wells situated near Maricopa, Twenty Five Hill, Fellows, and McKittrick, Cal., but this contained so much sulphur and salt that it could not be used for domestic purposes. The Kern Midway Water Company furnished the domestic water and transported it in tank cars 48 miles from Kern City. This water sold in the fields at 20 cents per barrel. This company sold water to the Twenty Three and the Railroad Water Company, who in return distributed it through small pipe lines to their various customers.

Pumping Station No. 1, Western Water Company, Taft, Cal.

In March, 1911, property was secured near the point where the Kern River turns into the lake, and about 12 miles from the oil fields. A test well was drilled and pumped continuously for six days to establish, without a doubt, the quantity and quality. Water suitable for both domestic and boiler purposes was found in abundance.

The plan was to install pumping machinery of sufficient size to pump 2,000,000 gal. per day to a storage tank on the highest hill in the field, known as Twenty Six Hill, and distribute by gravitation.

In July 1911, the company ordered 12½ miles of 12 in. 49 lb. plain end pipe, and sufficient had been received by October 1, 1911, to start laying it. This pipe is coupled with Dayton couplings, a style of coupling consisting of a body ring and two ring flanges, through which bolts are fitted and when drawn up, compress a ring of packing against the outside surface of the pipe, thus making a perfectly water tight joint. The use of this type of coupling facilitates repairs in case of leakage or damage to pipe line due to washouts, caused by heavy rains in the hills.

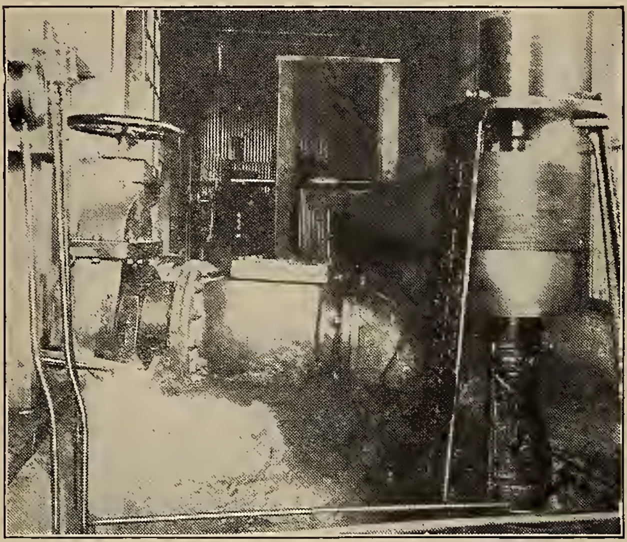
Pumping machinery for the two stations was ordered in July and arrived in September, 1911.

Station No. 1 is located near the water wells, and the machinery consists of two No. 7 Layne & Bowler vertical turbine pumps, the capacity of each being about 2,000,000 gal. per day. These two pumps are driven by one 50 h.p. Fairbanks-Morse single cylinder horizontal type engine for pump in well No. 5 and one 80 h.p. Fairbanks-Morse 3 cylinder vertical heavy duty gas engine for pump in well No. 7.

The elevation at the surface of the ground where these pumps are installed is 297 ft. above sea level. When not being pumped the water in the wells raises and runs over the top of the casing. When being pumped to the full capacity cf the pumps, the water is lowered only about 58 ft.

The water from these pumps is discharged into two 10 in. pipes, which connect to Y branches on the 14 in. discharge line leading to the concrete reservoir 672 ft. distant.

The reservoir is 40x100 ft. x 5½ ft. deep, divided into two basins 40x50 ft., so that one side can be emptied and cleaned without interrupting the water supply.


No. 7 Layne & Bower Vertical Turbine Pump, Driven by a 50 h.p. Fairbanks-Morse Horizontal Oil Engine.

The water first enters a sand box or settling basin before flowing into the reservoir, which prevents sand and silt from entering the 20 in. suction pipe leading to the 9x18 F.-M. power pumps in the main building. The elevation on the floor of this building is 310½ ft. Water is thus supplied to the pumps under slight pressure.

The equipment in the main building consists of three 9x18 Fairbanks-Morse pot valve power pumps, direct connected to three 250 h.p. Fairbanks-Morse four cylinder vertical heavy duty engines.

The gas for use in these engines is supplied from the Taft to Bakersfield pipe line of the California Natural Gas Company.

The pumps are fitted with 10 in. discharge pipes, which connect to the Y branch fittings on the 12 in. main line to Station No. 2 in Taft.

Each pump is fitted with a relief valve set at 550 pounds. The line pressure when plant is in operation being from 500 to 525 lb. per sq. in., 300 lb. of which is static and 200 to 225 lb. caused by friction in the pipe. There are also four alleviators on the main line at this point to take care of any water hammer that may occur.

All Y branches, gates and other fittings were placed in pipe line and tested to 1000 lb. per sq. in. hydraulic pressure.

The main building, 50x95 ft., is a substantial frame structure, covered with corrugated iron. The roof trusses are built to carry a load of two tons on the traveling crane, which is fastened to them. The crane was provided for the handling of heavy pump and engine castings, if necessary. The floors are concrete.

The power developed at this station is approximately 600

h.p.; the average consumption of gas per month is 5,500,000 cu. ft. Lubricating oil consumed averages 200 gal. per month. The oil is pumped from the crank case of engines to filters, and from there gravitates to the tanks that supply the oiling system.

For auxiliary equipment there is an electric lighting plant to light all the buildings; the engine of the light equipment also drives an air compressor which charges six receiving tanks.

Three 100 h.p. Titusville Tubular Boilers and Two 18x18½x18 Fairbanks-Morse Duplex Pot Pumps

The compressed air is used for starting the large engines, and by its use any one of the 250 h.p. engines can be easily started by a single operator.

There is also a refrigerating plant of one ton capacity, a machine shop containing lathe, drill press and pipe threading machine, etc., a blacksmith shop and a garage, also an oil house, where all waste oil is collected and filtered; also a heavy press for squeezing the oil out of wiping rags.

The 12 in. main line from Station No. 1 to Station No. 2 is laid in a direct line and crosses two ranges of hills, known as the Elk Hills, elevation 539 ft., and the Buena Vista Hills, elevation 1026½ ft. The lowest point is in the valley between these hills, with an elevation of 306 ft., this being 4 ft. lower than the floor of the No. 1 power house.

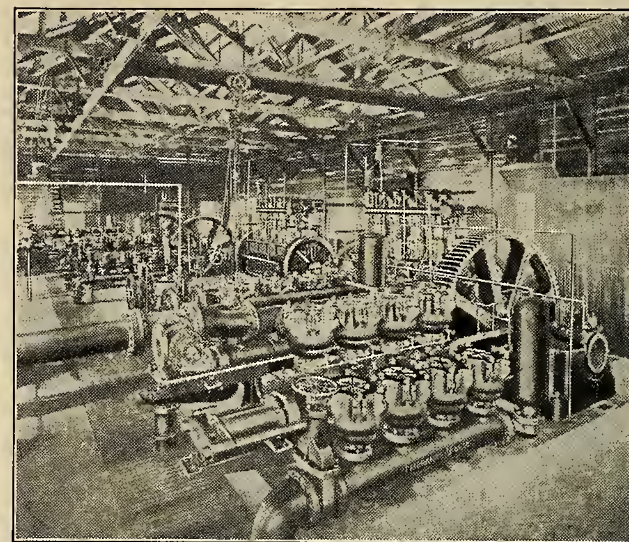
Station No. 2 receives the water coming through the 12 in. line from Station No. 1 in a 5000 bbl. tank near the power house.

The machinery in Station No. 2 consists of three 100 h.p. Titusville horizontal tubular boilers and three temporary 40 h.p. fire box boilers, one 18x6x18 Fairbanks-Morse Coalinga pattern pump, and two 18x18½x18 Fairbanks-Morse duplex valve pot pumps. The fuel used at this plant is natural gas, furnished by the California Natural Gas Company, and amounts to about 6,000,000 cu. ft. per month. This station is also equipped with a 6½x8 Rumsey triplex power pump driven by a 50 h.p. Fairbanks-Morse induction motor.

The structure which houses this machinery is a substantial wooden frame, and is covered with corrugated iron. The floors are of concrete, and all suction and discharge pipes are laid beneath the floor surface and the openings are covered, but all are of easy access.

The location of the company's property at Station No. 2 adjoins the city of Taft on the north. Water is discharged from the large line pumps in this station into a 12 in. manifold, to which is connected the 8 in. line, which discharges the water into the 55,000 bbl. storage tank on Twenty Six Hill, a distance of two miles. Another 8 in. line connects into this manifold, which supplies all of the lines of the Kern Trading & Oil Company; still another 8-inch line is connected, which supplies all the North Midway field. This line is of 8 in. pipe for a distance of seven miles, where it connects to six miles of 6 in. pipe.

The South Midway line is constructed of 8 and 6 in. pipe, and is nine miles long. It connects into all of the lines of the Kern Trading & Oil Company. The water supply in the city of Taft is furnished by the Consumers Water Company, who purchase water from the Western Water Company. The connection for this supply is also made at the station.



Three 250 h.p. Fairbanks-Morse Gas Engines, Direct Connected to Three 9 x 18 Fairbanks-Morse Valve Pot Power Pumps.

A new 8 and 9 in. line is now being constructed which connects into the 12 in. main line at a point 10 miles from Station No. 1, where the elevation is 730 ft. This line will supply Buena Vista Hills and the territory known as the Maricopa Flat. The length of this line will be 12 miles.

The elevation at Station No. 2 is 980 ft. 6 in., and at the 55,000 bbl. storage tank it is 1643 ft. At the extreme end of the North Midway line the elevation is 1272 ft. At Shale it is 1284 ft., and at Fellows 1294 ft. At the end of the South Midway line the elevation is 654 ft.

The system was completed in December, 1911, at a cost of over one-half million dollars, and the first water was delivered after six months of actual construction work—December 18th of the same year.

An unusual feature in connection with the operation of the system is that no trouble has been experienced with either machinery or pipe line. The 250 h.p. gas engines at Station No. 1 have operated continuously on an average of twenty-six 24-hour days a month for 20 months, and the 50 h.p. single cylinder engine pulled a load amounting to 60 h.p. for a period of 10 months.

The Western Water Company supplies water to approximately 60 per cent of the Midway-Sunset Oil Fields, the total acreage supplied is 30,720 acres of oil land. The water is sold at 3c per bbl., whereas heretofore operators have paid from 6c to 20c per bbl. At the present time 35,000 bbl. of 42 gal. each are being delivered daily.

The Western Water Company has proven itself successful both from a financial standpoint and for the purpose of its incorporation—that of supplying water to the largest oil field in the world, where the supply had heretofore been inadequate and spasmodic, causing immense damage through interrupted work from the lack of water at a critical time during the drilling of wells, etc. In the northern end of the field development had practically stopped because no water was available. The price of water was, in many instances, cut 50 per cent to 75 per cent.

NEWS NOTES

INCORPORATIONS.

LOS ANGELES, CAL.—Pacific Electric Car Company, $10,000, subscribed $30 by J. C. Wormley, H. D. Hattel, C. H. Van Velsor.

SAN FRANCISCO, CAL.—Central Electric Company, $10,000, shares $100 each, subscribed $300, by W. P. Smith, H. S. Ripley, B. B. Blake.

HOMEDALE, IDAHO.—Homedale Water, Light & Power Company has filed articles of incorporation for general business here. Capital $150,000. C. M. Hill, D. F. Sullivan, Otto Zimmerman, H. D. Gee and S. H. Clawson are the incorporators.

ILLUMINATION.

DILLON, MONT.—Residents of this city are considering the installation of a street lighting system in which electroliers will be used.

BUTTE, MONT.—A contract has been signed with the Montana Power Company for an ornamental street lighting system in the business section. Work is to be completed by July 1, 1914.

HUNTINGTON BEACH, CAL.—Inventory of the electric light plant of the Huntington Beach Company is being made with a view to its purchase by the Pacific Light & Power Company, which is to supply electricity to Newport Beach and whose lines are now at the city limits of Huntington Beach.

PORTLAND, ORE.—The Underwriters' Equitable Rating Bureau has directed the attention of all municipal electrical inspectors in the state of Oregon to the necessity for additional care in inspection during the holiday seasons that all decorations be installed electrically safe and the possible dangers thereby eliminated.

OREGON CITY, ORE.—Plans are being made and a preliminary survey has been started by the Portland Gas & Coke Company for a pipe line which will connect this city with the plant near Linnton. It is probable that the new line will go through Sellwood, Milwaukee, Gladstone, and end at Oregon City. The exact route has not been chosen.

SAN FRANCISCO, CAL.—A resolution calling upon the City Engineer's office for a comprehensive plan of street lighting at once economical and efficient, directing especial attention to preserving the rights of the city in making installations of new lights so that they can be turned over to the city eventually at the least cost, was adopted by the supervisors.

TRANSMISSION.

SAN FRANCISCO, CAL.—The commission has authorized the Pitt River Power Company to operate in sections of Shasta, Modoc and Lassen counties if the company obtains satisfactory franchises in the counties named.

SAN BERNARDINO, CAL.—The Pacific Electric Company will build two new power houses at once, one to be located in San Bernardino and the other in the vicinity or Etiwanda. Contracts for construction of these will be let in the near future. Both buildings will be of reinforced concrete construction.

SAN FRANCISCO, CAL.—An ordinance giving the City Electric Company permission to string wires and erect poles in the Exposition grounds without a franchise, has passed the supervisors on the recommendation of Supervisor McCarthy of the exposition committee. It is similar to others agreed upon giving extraordinary powers to the Exposition company during the life of the World's Fair.

PORTLAND, ORE.—The Oregon Hydroelectric Commission, which had its inception in a plan advanced at the commonwealth conference at the University of Oregon last spring, held its initial meeting at the Portland Chamber of Commerce Saturday, December 13. The purpose of the commission is to arrange for funds to conduct a worldwide study of electric power and the methods and cost of its production and application to manufacturing industries, with the view to formulating a basis on which the vast waterpower resources of Oregon may be developed. The plan for the commission was suggested by Professor F. G. Young of the University of Oregon, and State Engineer Lewis.

AUBURN, CAL.—The Pacific Gas & Electric Company, by its attorney, John M. Fulwieler of this city, has filed papers in a suit of condemnation against J. L. Rollins, Thos. E. Morgan, J. C. Hawyer and Dan Kirby, as trustees of the Erie Mining Company to have the land covered by certain mining claims on Bear River, near Colfax, condemned for a dam site. The ground wanted by the Pacific Gas and Electric Company is located just above the head of the Bear River ditch in Nevada and Placer counties, extending up to the mouth of Little Greenhorn Creek, and the claims would be subject to flooding during high water stages, when the natural flow of Bear River would be augmented by 15,000 miners' inches of water pouring into the river from the newly installed power house at Drum, which is brought from the Yuba River at Lake Spaulding.

OROVILLE, CAL.—According to reports received here from Big Meadows the work of the Great Western Power Company of filling in the earth dam above the concrete dam in Big Meadows is nearing completion. About 200 men are still employed on the works, and the operations will be continued to a limited extent through the winter. The dam will be rip-rapped with heavy rock and the spillway will be constructed of concrete. As it now stands the bulwark has a base of about 600 feet and stands 62 feet high. No attempt will be made, it is reported, to install a power plant just below the dam on the north fork of the Feather River for several years, as the immediate purpose for which the dam will be used is to store sufficient water in order that the flow in the north fork may be equivalent through the summer months, thus giving sufficient water for the development of more electric energy at the Big Bend plant, where two additional units are now being constructed.

LOS ANGELES, CAL.—A contract between the city and three power companies in Los Angeles is being drafted by City Attorney Stephens that is expected not only to be approved by the City Council, but accepted by the power companies. This statement is based upon the successful termination of negotiations between the City Attorney and counsel and officials of the power companies. The contract provides the following definite propositions: (1) The city to lease the distributing systems of the power companies for a period of five years. (2) The power companies to sell to the city at the end of that time at a price to be determined by an appraisement of the State Railroad Commission. (3) The city and power companies to supervise the operation of the municipal distribution system under the direction of a board of control composed of three members named by the city, three named by the companies. It is proposed to have the city make all extensions to the power systems, to unify the service and to make all preparations to take over the entire system at the end of the leasing period.

TRANSPORTATION.

GLOBE, ARIZ.—The city council has revoked the Amster franchise for an interurban electric line between Globe and Miami, insofar as it effects streets of Globe.

LOS ANGELES, CAL.—Fire destroyed the Pacific Electric car barns at Sherman a few days ago, causing damage of $25,000, which was little more than value of the barns.

DIXON, CAL.—After a long discussion on the matter of the applications of the Northern Electric and Sacramento Valley railroads for a franchise in this city in which representatives of both roads and citizens took part, it was decided to grant both the roads a franchise for the use of a joint track.

FRESNO, CAL.—The financing of a new electric interurban line from Fresno to Academy by way of Clovis, to tap a hitherto uninvaded fruit and mineral territory of the foothills, is assured, according to F. S. Granger of Fresno, promoter of the enterprise. Mr. Granger is well known as the promoter of the interurban electric railroad from San Jose to Los Gatos and to Saratoga Springs. This line, originally twenty-seven miles in length, is now being extended to Palo Alto.

SAN FRANCISCO, CAL.—With the acquisition of the Presidio and Ferries Railroad the mileage of the municipal lines is doubled. More new lines are being projected. One that is to cross Golden Gate Park at Tenth avenue, going out Kirkham street to Forty-fifth avenue and thence to Sloat boulevard, promises to give the residents south of the park the transportation facilities they have long been demanding. These lines, with the ones to be built with the proceeds of the recent bond election, will give San Francisco the nucleus for a transportation system of considerable proportions.

OAKLAND, CAL.—At a recent meeting of the stockholders of the San Francisco & Oakland Terminal Railways, two-thirds of the stock was represented. W. A. Bissell, president of the company, presided. The meeting was called for the discussion of the project of raising the bonded indebtedness of the company from $20,184,000 to $21,184,000. The stockholders agreed to the project, and it is expected that the bonds will be used as collateral. This is the first of several steps to be taken in the settling of the affairs of the company. These will be discussed at another meeting set for December 23.

TELEPHONE AND TELEGRAPH.

MALAKWA, B. C.—It is reported that a company will be formed here to install a local telephone system.

EMPIRE, CAL.—The Empire Telephone Company has applied to the commission for a certificate of public convenience and necessity to operate in and about Empire, Stanislaus county.

RIVERSIDE, CAL.—Bids will be received up to December 29th, for a franchise granting right to construct and maintain telephone and telegraph wires over streets and public places in this city.

TERRA BELLA, CAL.—The Deer Creek Rural Telephone Company applied to the commission for authority to sell its plant located at Terra Bella, Tulare county, to the Pacific Telephone & Telegraph Company.

EDMONTON, ALTA.—In the neighborhood of $2,000,000 will be expended by the Alberta government on telephone extension work during 1914. This will include the erection of a large number of exchanges.

SAN RAFAEL, CAL.—The Pacific Telephone & Telegraph Company has just completed its new telephone line to McNear's Landing. This additional equipment will feed the Uplands Tract, Bayside Acres, Mt. Venice, San Francisco Quarries Company and Daniels Contracting Company, connecting these points directly with the San Rafael exchange.

VANCOUVER, B. C.—It is reported that the Dominion Government contemplates constructing a new wireless station on Chatam Point, midway between Cape Lazo and Alert Bay. This is the only section of the British Columbia coast not covered by wireless system. With its establishment steamers plying up and down the coast between Vancouver and Prince Rupert will at all times be in touch with wireless stations.

SAN FRANCISCO, CAL.—Supervisor Hilmer of the Telephone Rates Committee has called the attention of the public to the fact that if the telephone rate ordinance is sustained by he federal courts subscribers will be refunded all charges the company is collecting in excess of the rates fixed by the supervisors. He gave this warning because of the efforts of certain persons to secure contracts from subscribers to collect refunds on a percentage basis. The company is keeping two accounts with consumers and will make the refund voluntarily if the court decision is adverse to it.

STOCKTON, CAL.—Within a few months the Pacific Telephone & Telegraph Company will expend about $50,000 through the Stockton offices to improve its long distance service throughout the San Joaquin Valley. Three thousand dollars will also be spent to install additional equipment in this city to increase the efficiency of the local service. The work on the valley improvements will be started about the first of the year. Two more circuits will be installed between this city and Modesto, and four additional long distance wires will be run between Stockton and Fresno, touching Modesto, Merced, Madera and other points along the line, 250 miles of wire.

VANCOUVER, B. C.—The new Canadian government telegraph line connecting Vancouver with Newport, the terminus of the Pacific & Great Eastern Railway, is open for commercial business. The line connects at Newport with a 47-mile telephone line into the interior, constructed by the contractors of the Pacific & Great Eastern Railway, and when eventually completed to Lillooet will connect with the recently completed government telephone line from that point to Lytton, on the main line of the Canadian Pacific Railway, giving service to the ranchers of the Fraser Valley. Before completion of the line to Newport the only method of communication with that point was by daily boat.

WATERWORKS.

SUNNYVALE, CAL.—The people of this city have voted to incur a bonded indebtedness of $75,000 for sewer and water systems.

SANGER, CAL.—Two bond propositions carried by a large majority; bonds for a sewer system were for $30,000 and for the water system $32,000.

SEATTLE, WASH.—Water system franchises have been granted to the Lake Forest Light, Water & Power Company and to the Lakota Water Company.

VICTORIA, B. C.—The city council has awarded the contract for the concrete flow line for the Sooke waterworks to the Pacific Lock Joint Company. The amount of the tender is $329,760.

TUCSON, ARIZ.—Bonds in the sum of $165,000 to be used in improving the city water system in accordance with plans prepared by the city engineer, have been voted by the people of Tucson.

TACOMA, WASH.—The city council has voted to install water mains in the Fern Hill District at an estimated cost of $23,878. This improvement included about four and one-half miles of mains.

LOS ANGELES, CAL.—Judge Myers of the superior court has authorized Col. Holabird, receiver for the California Development Company, to enter into a contract to supply the owners of 4000 acres of land in Imperial valley with water.

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Devoted to the Conversion, Transmission and Distribution of Energy

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SYSTEM OF MT. WHITNEY POWER AND ELECTRIC COMPANY.
BY RUDOLPH W. VAN NORDEN.

FIRES AS A CAUSE OF SHORT-CIRCUITS ON HIGH VOLTAGE LINES.
BY J. C. CLARK.

PUBLIC UTILITY ACCOUNTING IN OREGON.

"PARTNERSHIP" VS. "PRINCIPAL AND AGENT" IN PUBLIC UTILITY RATE-MAKING.
BY J. F. DIX.

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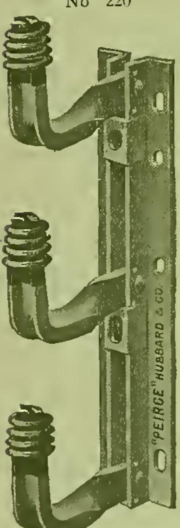
Alphabetical Index to Advertisers, Page 8.

Where to Buy It in the West, Pages, 9, 10.

Peirce Cross Arm Strap for service brackets—no boring, no weakening of cross-arms.

Peirce High Carbon Steel Pins are one piece forging—note the spring thread—no insulator troubles.

No 220



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Peirce Cross Arm, 2 and 3 point brackets, for service lines. No strain on cross arm pins, crossed wires obviated, quickly placed, cheaper and better than a buck-arm.

PEIRCE POLE LINE MATERIAL and SPECIALTIES

ALL STEEL---CHEAP---EFFICIENT

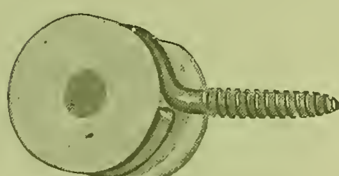
They save labor—They are all hot dip galvanized.

No. 35

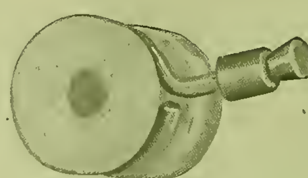
No. 10

No. 25

Peirce Wall Brackets, 1, 2 and 3 points, cheap—stand heavy strains, are quickly attached. Straps prevent rocking on the wall.



Peirce Knob Screw—all in one piece—the lineman's time saver.



Peirce Knob Bolt for attaching to brick and cement walls.

"If its Peirce, its satisfactory"

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House

Distributors for the Pacific Coast

SAN FRANCISCO OAKLAND LOS ANGELES PORTLAND SEATTLE

THE PACIFIC STATES ELECTRIC CO.
SERVES
THE PACIFIC COAST

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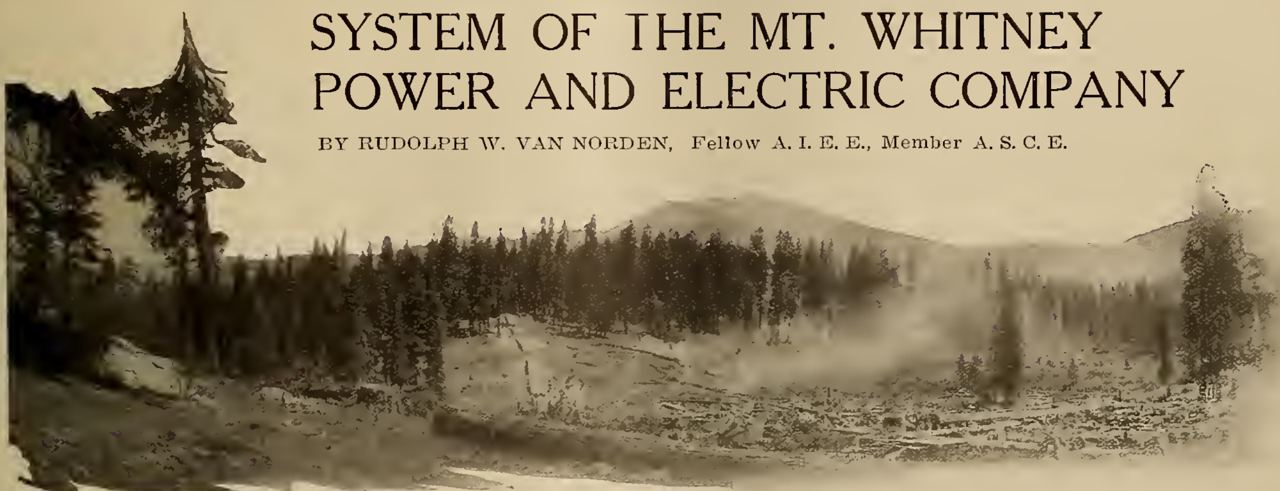
SYSTEM OF THE MT. WHITNEY POWER AND ELECTRIC COMPANY

BY RUDOLPH W. VAN NORDEN, Fellow A. I. E. E., Member A. S. C. E.



Site of the Wolverton Reservoir, Showing Excavation for Coı crete Toe of Dam.

The east half of the San Joaquin Valley of central California, is a vast plain of tillable, productive land, whose potential value manifests itself in the prolific outpourings of its hidden resources only by the application of a constant supply of water.

For many years this land was "dry-farmed." Wheat was the staple. The romance of the old life on these great ranches and the hardships of the droughts has been pictured by Frank Norris in "The Pit." But it has remained for the magic power of electricity to make possible the modern reality of quenching the thirst of this otherwise favored area.

A vast subterranean reservoir is so near the surface that deep-rooted trees can suck up the water and flourish through the long dry season. Electric power can be cheaply generated in the neighboring Sierras to pump water to irrigate a million acres. Here is the greatest and most desirable form of load that a power company could wish, and here the Mt. Whitney Power & Electric Company has built up an unparalleled business, based upon supplying electricity for pumping water. Thus is intensive cultivation, converting the potential value of the great ranchos into the kinetic production of the small farm. The consequent rapid increase in population has in turn built up a market for industrial and domestic power, which supplements that needed for pumping.

The operations of the Mt. Whitney Power and Electric Company dates from June, 1899. The first plant represents almost a pioneer effort in the history of long distance transmission. But one or two plants had previously attempted to operate under so high a head. While the plant was small compared with the present day hydroelectric installations, it compared favorably in size with the few plants then in existence.

The idea of pumping the underground waters for irrigation was a conception originating with this project. Nowhere else had such a plan been considered feasible, and the small amount of pumping in this district by gasoline or steam was inefficient and costly, and canal irrigation was absurdly inadequate. The business to which the company first catered was therefore largely pumping and a small amount of lighting. It may be said that electrical irrigation pumping was developed by this system and was well established for many years before it had been adopted in other parts of the state by other electric power companies.

To study the growth from this first installation to that of the present, when there are four hydraulic power plants and one steam plant, and a network of transmission and distribution lines, aggregating 1262 miles, forms a most interesting illustration of how a great system is being gradually and conservatively built to meet the demands of a growing and prosperous population.

The increment of gain in the kilowatt hour output has been increased each year, the last year's increase amounting to 36 per cent. Both the gross and net earnings have increased in about the same proportion. This is readily shown on the accompanying chart in which the monthly kilowatt output is

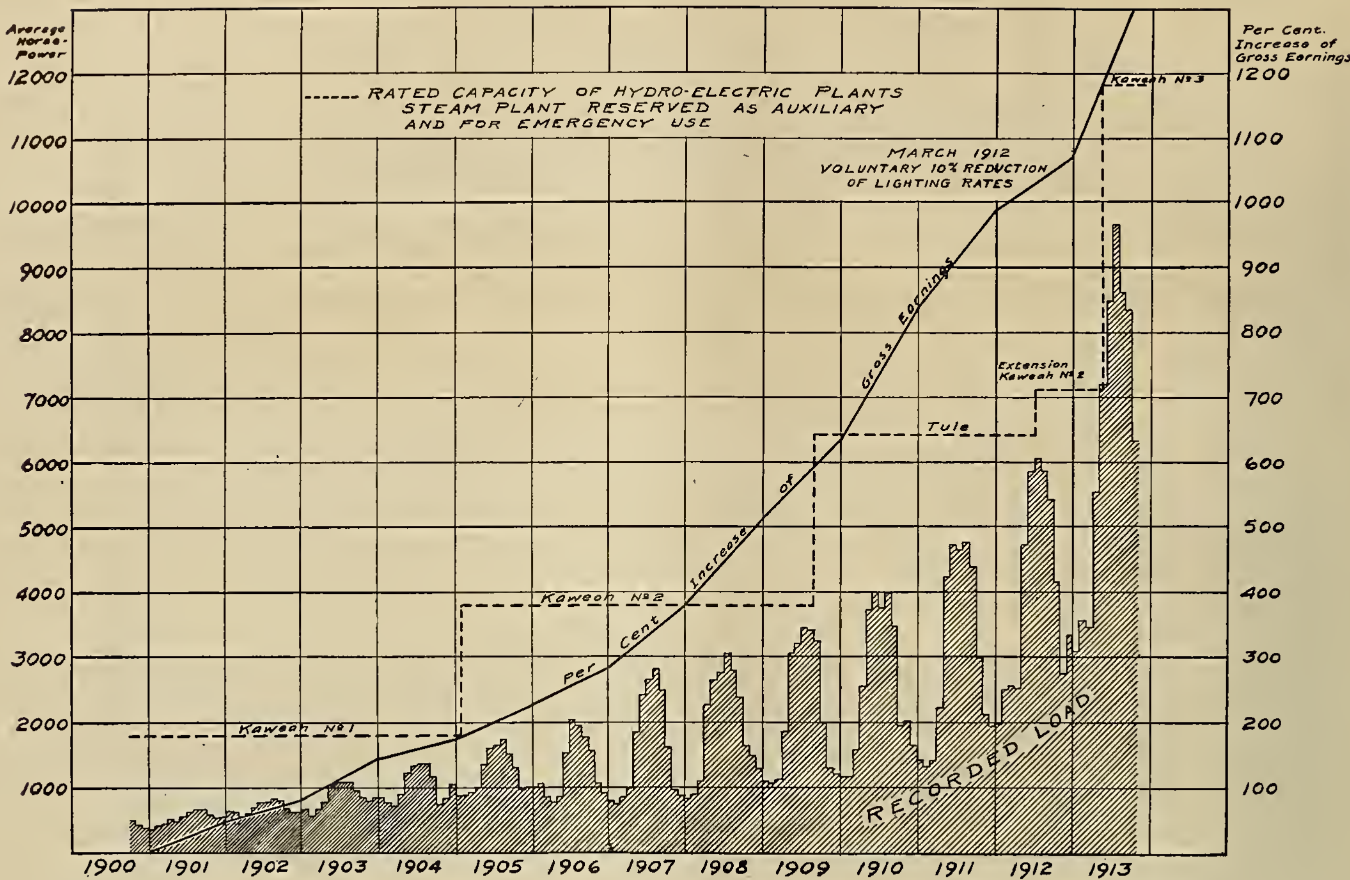


Chart Showing the Monthly Recorded Load in Terms of Horsepower, the Plant Capacity, and the Percentage of Increase of Gross Earnings With Reference to the Power Delivered.

graphically recorded. In this case the gross earnings in terms of percentage increase are also shown. A study of this chart will give a comprehensive understanding of the operations and business of the company. While but 8½ per cent of the territory reached by the lines of this company is as yet under cultivation, and hence requiring power, it is an interesting fact that for each mile of line there is installed 9½ h.p. in motors for irrigation pumping alone.

Hydrography.

The plants of the Mt. Whitney Power & Electric Company derive their water supply from two distinct watersheds of the western slope of the Sierra Nevada Mountains. These comprise the East, Middle and Marble Forks of the Kaweah River, and two forks of the Tule River. The former watershed is the more northerly, has an area of 250 square miles and its elevations range from 2600 to 12,400 ft. at its eastern boundary. The latter watershed has an area of 88 square miles and its elevations rise to over 10,000 ft. On the eastern boundary of the watershed there are several peaks approaching 15,000 ft., and Mt. Whitney, the highest of these and the highest peak in the United States outside of Alaska, exceeds this average. Their characteristics are similar in that the formation is largely granitic. The Kaweah watershed has more or less timber covering and much brush. Within its bounds is the Sequoia Giant Forest, which is famous for the number and size of its redwood trees. A characteristic of both watersheds is the rapid fall of the river-beds. This will amount to 300-400 ft. to the mile, and follows the general precipitous nature of the rugged country. Above 4000 ft. a heavy covering of snow is found throughout six months of the year, and at the extreme altitudes much snow remains the year round. The water flow during the melting time of the snow is necessarily large.

The precipitous canyons afford little possibility for the construction of reservoirs. A number of small natural lakes have been increased by the construction of dams, and these serve to augment the low water flow. One reservoir of importance, the Wolverton, will be described later.

Kaweah No. 1 Plant has its diversion in the East Fork of the Kaweah about 5 miles above its junction with the Middle Fork, where about 20 cu. ft. per second flow is available during the season of low water, storage being secured from several natural lakes in the high Sierras. These include Lady Franklin Lake, impounding 23 million cu. ft. of water, Silver Lake, Eagle Lake and Monarch Lake, whose estimated storage is 21 million cu. ft.

The diversion is at the outlet of a natural basin where a small granite masonry dam maintains the water level for the intake to the conduit. A 50 ft. tunnel through a jutting rock spur delivers the water from this basin to a timber flume. This flume has a capacity of 17 cu. ft. per second and is 30,000 ft. long, following the very precipitous mountain side of the south slope of the canyon.

In construction it follows the practice common in California at the time it was built. It has a section 3 ft. wide, and 2 ft. deep, and is supported on a timber structure, varying in height with the ground contour, from 6 to 50 or more ft. as the case may be. Redwood 1½x12 in. planks are battened with 1x4 in.

A Young Orchard Near Lindsay, Showing Pumping Plant Necessary for Its Development.

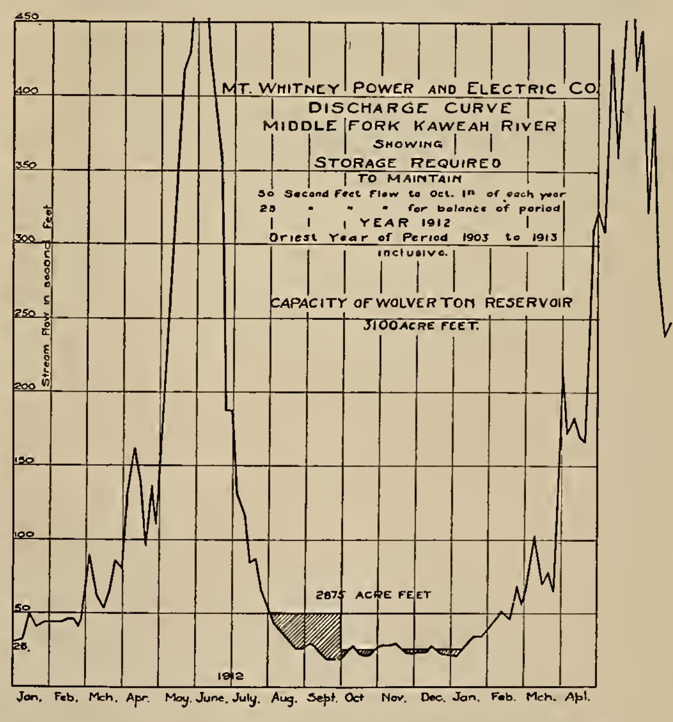
strips. The grade is rather heavy, being 20 ft. to the mile. Sand-traps are provided at frequent intervals, and at the lower end the water is emptied into a long sand box, 10x10 ft. by 200 ft. long, which has an apron spillway. From this the flow is carried into a wooden penstock, 6x8 ft. and 16 ft. in depth. The sandbox is provided with flush and overflow gates.

When this plant was constructed, it was not deemed advisable to take this flume out at a higher altitude, as the head on the power house was as great as was considered safe. Progress has since been made in the design and construction of all hydraulic apparatus. Above the intake a series of waterfalls make it possible to increase the head about 450 ft. To accomplish this a new canal is to be built on more modern and permanent lines to terminate directly above the present penstock. There is also an opportunity at this point for a regulating reservoir, a necessary and valuable adjunct with a plant of this kind. By means of this improvement the head on the plant will be increased to 1750 ft.

During a large part of the year a flow of 40 cu. ft. per second is possible from the East branch of the Kaweah River. As the present arrangement of the system compensates for lack of power over a short water period, by steam generation, it is thought advisable to design this new canal for the full flow of 40 cu. ft per second. With the aid of the regulating reservoir the power house may be rebuilt to handle as high as 60 cu. ft. per second, due to the daily variation in the load factor on the plant.

The output possibility of this installation can thus be increased at least fourfold. This improvement is contemplated for the near future.

Kaweah No. 2, the second plant to be built on this watershed, was completed in 1905. The diversion is in the Middle Fork, about one mile above its junction with the East Fork. This diversion was



A Mountain Meadow in the Kaweahs.

made at a natural dam site, between two granite ledges, and consists of a low granite masonry dam, whose maximum height is 8 ft. At the west end is the intake for the canal, in which are four hand-

View of the Flume Supplying Kaweah No. 1 Plant.

operated sluice gates, each 2 ft. 5½ in. wide by 6 ft. 6 in. high. The canal follows the hillside for a distance of 4 miles. Of this 3.15 miles is in concrete-lined ditch. The remainder is divided into several sections of timber flume. This conduit has a capacity of 80 cu. ft. per second. The ditch is 4½ ft. wide at the bottom, and 11½ ft. at the water surface, with a depth of 3½ ft. The grade is 5.28 ft. to the mile. Both bottom and sides of the ditch have a lining of concrete 3 in. thick, with a plaster coating to give a smooth surface and reduce friction. The flume is built of 1½ in. lumber, it is 5 ft. wide and 4 ft. deep and follows good standard California practice. At a number of points it is elevated on trestles. At the end of the canal line is a small forebay, being in reality an enlargement of the concrete lined ditch. This has a length of 270 ft., is 12 ft. wide and 9 ft. deep. At the lower end is a set of 5 sliding gates to allow the water to pass into the head of the pressure pipe line. The elevation of the intake of this canal is 1400 ft.

Kaweah No. 3 was placed in operation in May, 1913, and represents the latest development for this system. In location the power house is directly above the intake of the No. 2 plant, so that its discharge is caught behind the dam of No. 2, and immediately diverted into that canal. No. 3 plant derives its water from two diversions, one in the Middle Fork, about three-fourths of a mile above the junction of the Marble Fork, while the other is in the Marble Fork, about the same distance from the junction already mentioned. The water area available for this plant is practically the same as for the No. 2 plant, with the exception of a small amount of water, which may come in between the points of intake of the two systems.

The diversion in the Middle Fork consists of a concrete dam, having an Ogee section. This dam is a small affair, placed at a natural site in the bedrock of the stream. The intake on the south bank is formed by a heavy masonry wall extending to form the outer wall of the canal as well as a waste wier to return water to the river. Beyond this wall is a set of sluice gates, which controls the flow into the canal. These are protected by trash racks, and a sandbox.

The diversion from the Marble Fork is quite similar. The bedrock is largely, as the name would imply, of a light colored marble, and required little concrete to make a well designed and serviceable dam. Flow control is also similar to that in the Middle Fork. The canal is carried along the north bank of the Marble Fork to above the junction of the two branches. Here it is terminated by a sandbox and an overflow siphon, an interesting individuality which enters into the construction of this system. This terminus, which is a concrete lined box, acts as a head-box for a steel inverted siphon, which carries the flow of this canal across the Middle Fork, to a junction with the canal line from the Middle Fork diversion.

The waters of the two branches are thus mingled, and are then carried in a continuation of the Middle Fork conduit, which follows the east slope of the Middle Fork, to a terminus in a forebay res-

The Diverting Dam and Intake for the Kaweah No. 2 Canal.

ervoir for the No. 3 power house. This conduit line has a number of points of interest to engineers, as

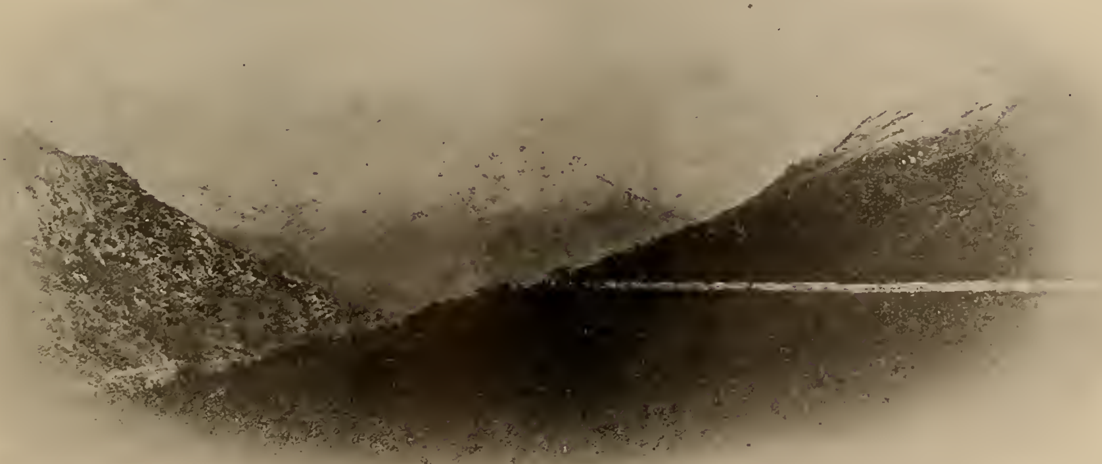
it is quite unique in its design and method of construction, and represents the latest engineering effort of the company along this line. The ground surface followed by this conduit line is very rugged and uneven. In the construction of the conduit, a bench was first made. This was excavated partly by hand, and partly with the aid of a ¾ yd. Thew steam shovel. Wherever the excavation was such that a ditch section could be used, a berm was left for this purpose. These sections were lined with concrete 3 in. thick, in a manner similar to that of the No. 2 canal.

The total length of this conduit, including both branches is 25,000 ft. Of this, 5000 ft. comprises the section from the diversion in the Marble Fork, including the inverted siphon. The Middle Fork branch is 3300 ft. long. The remainder is the conduit from the junction to the forebay reservoir. The Marble Fork and main sections are built upon a grade of one foot in 1000 ft. Of this 6000 ft. is in concrete lined ditch, having a bottom width of 6 ft., a depth of 4 ft. and whose sides have a batter of 1:1. The remainder of this branch is in the slab bench construction, of which 12,700 ft. is on single slab construction, and 3000 ft. in double slab construction. Where the single slab is used half of the ditch is similar to the lined section, in that the inside slab has a 1:1 batter, and the concrete is formed on the ground surface, while the outside wall is a vertical slab, which is transported from the point of manufacture, and set in place. The double slab construction has both sides built of the portable slabs, while the bottom is laid on the ground surface.

That part of the main canal which receives its water from the diversion in the Middle Fork to the point of junction with the siphon from the Marble Fork, is built on a grade of 2 ft. in 1000 ft. This section consists of 3300 ft. of concrete flume, having a width of 6 ft. inside, and a depth of 3 ft. This flume is built of portable side slabs, but contains also a reinforced concrete bottom slab, and the entire flume is supported at the joints upon rubble masonry piers.

(1) The Diverting Dam and Intake Canal in the Marble Fork, Plant No. 3.
(2) Beginning of No. 3 Canal From the Marble Fork Diversion, Showing Gates and Trash Racks.
(3) Typical Section of No. 3 Canal, Showing Full Slab Construction.

The inverted siphon, which carries the flow from the Marble Fork diversion across the Middle Fork to



General View Looking Up the Marble Fork, With Middle Fork in the Foreground. No. 3 Canal Is on the Right. The Proposed No. 5 Canal and Pipe Line Is Located in the Center Background.

(1) Portable Concrete Mixer for Lining No. 3 Canal.
(2) Transporting Slabs.
(3) Full Slab Construction From the Middle Fork Intake, Before Forming the Pilasters.
(4) Same View After Pilasters Have Been Formed, and Flume Completed.

the point where it joins the main canal, is a riveted steel pipe 48 in. in diameter, and 1/4 in. thick. Where this pipe crosses the bed of the Middle Fork, it is buried in a bed of solid concrete. When this work was constructed a second section of pipe was laid beside the present pipe in the concrete bed. This is to provide for a second inverted siphon, which shall be completed when the entire development of the No. 3 plant shall have been made. The object of the concrete bed over the pipe is to allow the flood waters of the river to pass over the pipe without any possibility of damage to the pipe, or of obstruction to the bed of the channel. The length of this inverted siphon is 1085 ft., and the maximum static head is 125 ft. At the lowest point there are outlet valves for the purpose of draining the pipe.

Wherever the ground surface offered a good support on the inner side, but not on the outer side, the bottom and inner slope were lined in the usual manner with concrete, but the outer wall of the canal was made of formed slab sections of reinforced concrete, which is another of the principal engineering characteristics of this line. All remaining sections of the line were built of formed concrete sections. In the making of the reinforced sections a space between the two forks was found of sufficient size and approximately level for a yard, in which the slabs used in the construction, could be made in large quantities. Gravel and sand were available in abundance in the nearby stream beds. A crushing plant was built with a large bunker capacity, and tracks for moving the sand, and removing the crushed rock from the crushers were built. Wooden forms were used to make the slabs, which were distributed throughout the slab yard, so that they could be readily handled when they had become sufficiently hard for transportation. The slabs are "L" shaped, the longer leg of the slab forming the side, while the shorter leg is an unfinished section of the bottom for the canal. The slabs were reinforced with Clinton wire fabric, having 4x12 in. spacing and No. 3 and No. 12 wire respectively, and they had additional reinforcement of two 5/16 in. twisted bars running lengthwise. The width of the slab at its upper edge is 3 in. This increases to 4 in. at the bottom. The length of the slab is 12 ft.

A track from the slab yard was built on an easy grade following the Marble Fork until the conduit grade was reached. This track was also continued in the opposite direction, crossing the river and up the further side until the grade of the main canal was reached.

Special double truck cars were used on which was a frame, and upon which could be loaded two slabs, straddling the frame. The portable derrick for lifting the slabs was also mounted on a car, and this followed the slab car to the point where it was desired to set the slabs down. In construction the slabs were carried to the lower end of the conduit line, and placed, the canal being built back toward the in-

take. A track was laid along the bottom of the canal, for the purpose of transporting the slabs and material and a gasoline locomotive was used. As the slabs were set in place, the bottom was filled in between the "L" branches of the slabs and finished with a fillet over the L extension. The reinforcement was not carried across, but extended well into the concrete bottom. Where a canal grade could not be economically made, the slabs were supported on piers, and in this case the bottoms are also formed slabs, and were properly reinforced to carry their weight, and that of the water in the canal.

The slabs were placed end to end, and the joint between them was made by means of a pilaster on the outside of the slab. In building the pilasters a foundation or base about 2 ft. square was first filled with concrete. A metal form was then set up, and the longitudinal bars of the reinforcement of each slab were bent outward, twisted together and allowed to extend into the pilaster. The pilaster form was then filled with concrete, and the point between the slabs was filled flush and smooth with concrete plaster.

All bends in the conduit line were, of course, made at the points of joining of the slabs, and the pilaster was simply formed to take up any angle between the ends of the slabs. This construction, while unique, has proven itself extremely serviceable in a situation of this kind where it is difficult to transport materials, difficult to handle heavy machinery, and concrete and labor are both high in cost. The over-all cost of this construction, including the benching, manufacture of the concrete slabs, and the finishing, was approximately $40,000 per mile.

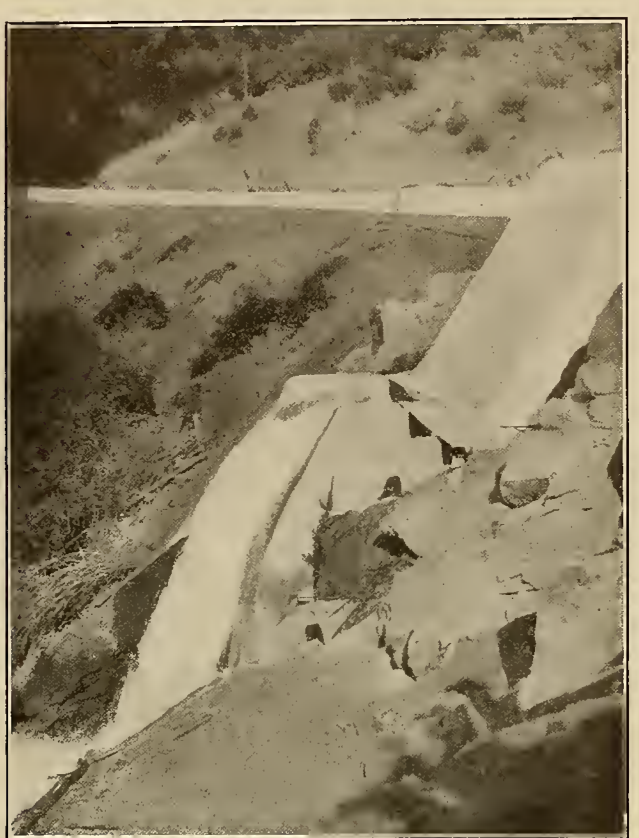
(1) Control Gates in Marble Fork Diversion of No. 3 Canal.
(2) Entrance to Inverted Siphon Crossing the Middle Fork. The Siphon Shows in the Background, Where It Joins the Main Canal.

Along the line of this conduit there are five corrugated iron tool houses. These are placed at convenient points where cement may be stored, and where tools may be kept for the repair of the line. There are several sandboxes, which consist of a depression in the bottom of the canal, and a reinforced concrete box built out from the side, in which are placed two sluice gates. The bottom of the sandbox is 3 ft. below the bottom of the canal. A second and unique feature of this conduit line are the waste-way siphons. The flow of water over a weir is well understood, and is practically a fixed amount depend-

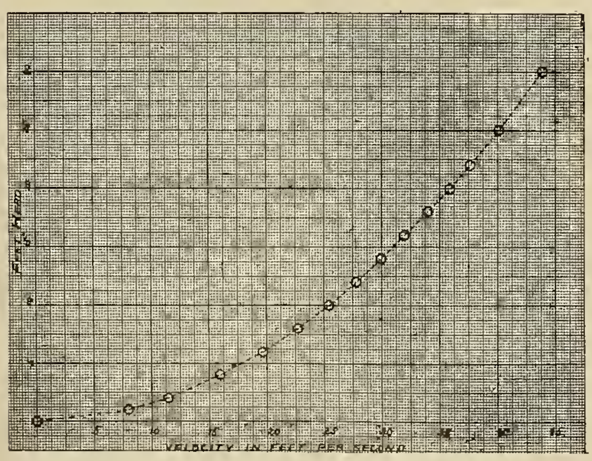
Views on No. 3 Conduit.
(1) Typical Sandbox.
(2) Lower End of Concrete Flume, Showing Discharge Siphon Operating.
(3) Junction Between Concrete Lined Ditch and Slab Flume, Showing Deer Bridge Required by the U. S. Government.

ing upon the head of the weir. In a system of this kind it is not desired to allow the head to increase very much above a certain point. To take care of all the water that may be necessary in the case of such a rise, would require many waste-ways of extreme length. For this reason the siphon was designed and these have been installed, where a large flow could be taken out of the canal with little increase to the head of water above the point where this flow commences. This is made possible by the familiar principle of the siphon. There are three large siphons, two at the end of the Marble Fork conduit, and the other at the forebay reservoir, and these have three parallel compartments, and are built of reinforced concrete. In action, the water after rising to a certain

point where it enters the siphon, flows over a weir edge inside of the structure. It then flows down a chute, which is also enclosed in the structure, into a bowl shaped receptacle. When this flow becomes


A Discharge Siphon in Operation.

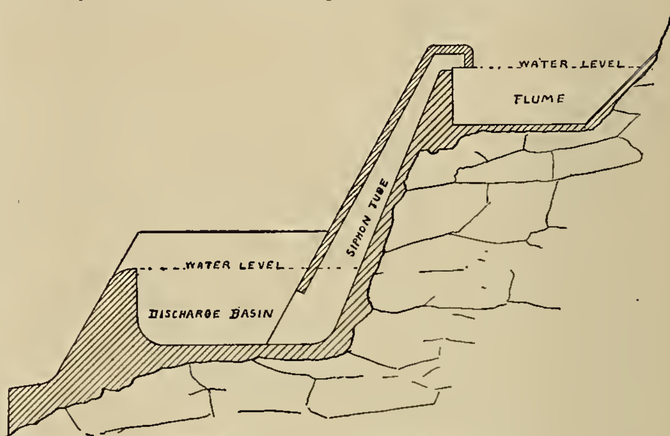
great enough to fill the siphon, the bowl acts as a water seal, thus cutting off the air supply into the bottom of the siphon. The water level already acting as a water seal at the top, completes the siphon action, and the flow from the canal is immediately increased to that which would be due to a head or draught equal to the height between the water level in the canal and the water level in the bowl at the bottom of the siphon. By this means the ordinary



Curve of Discharge From Siphon.

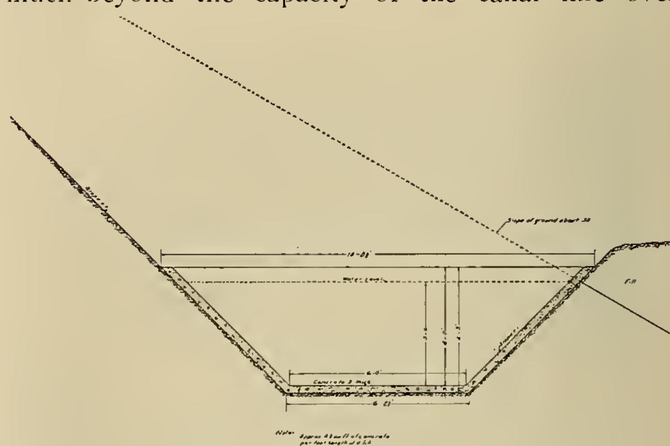
weir flow is increased to a great extent, and the siphon will take care of all the water which it may be desired to waste at this point. After the surface of the water in the canal is lowered to the point where the airlock at the top is destroyed, the siphon ceases to act. It is therefore, automatic in its operation. At intervals along the canal are six, one-compartment siphon spillways which are provided to discharge flood waters entering the canal from the adjoining hillsides.

A third interesting feature of this conduit system is the forebay reservoir at the terminus of the line. Originally the site was the point of a hill, which presented apparently no opportunity for a forebay reservoir. This point was leveled off until



Cross Section of Discharge Siphon.

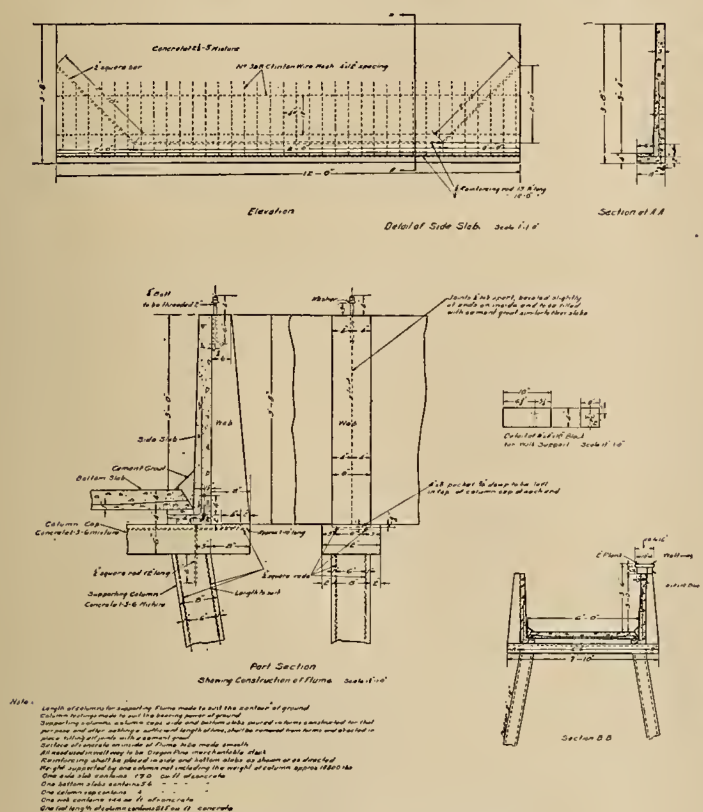
the surface was approximately the shape of a crescent. It was then excavated, leaving an outer wall and having a depth of 22½ ft. This work which has now been about completed, while it has been costly, makes possible a reservoir which will have a capacity of 11½ acre. ft., and by this means the output of the power house may be greatly increased by operating much beyond the capacity of the canal line over


Typical Cross Section of No. 3 Concrete Lined Ditch.

peak loads. The total excavation of this forebay reservoir was 50,000 cu. yd., and this has been practically all in rock. The pipe lines to the power house will commence at the reservoir, although the present pipe is taken directly from the canal.

Kaweah No. 5 is a proposed new development between the intake of the Kaweah No. 3 system in the Marble Fork, and the Wolverton reservoir on a branch of the Marble Fork, there is a drop of over 3,000 ft. Of this drop the latter half is suitable for a power development, with a very short canal line. This project has been surveyed and work will be commenced during the coming year. It is proposed to divert the flow of the Marble Fork about 2½ miles

up stream from the present No. 3 diversion, and carry this flow in a reinforced concrete flume similar to that of the No. 3 system, to a point directly above the No. 3 intake. It is also possible to make a diversion at this altitude from the Middle Fork, and bring its water into this plant. The pipe line



Cross Section of No. 3 Slab Flume.

will be direct, and upon a heavy incline down the mountain side to the power house, which will be placed immediately above the present diversion in the Marble Fork. This plant will have an installation of 10,000 h.p.

The Kaweah No. 3 and No. 5 systems have been designed throughout by the company's engineering department, and the work of construction of the former system has been prosecuted entirely by the company's forces, under the direction of Mr. John Coffee Hays, the consulting engineer; Mr. H. A. Kluegel, chief engineer, and Mr. F. G. Hamilton, engineer of operation.

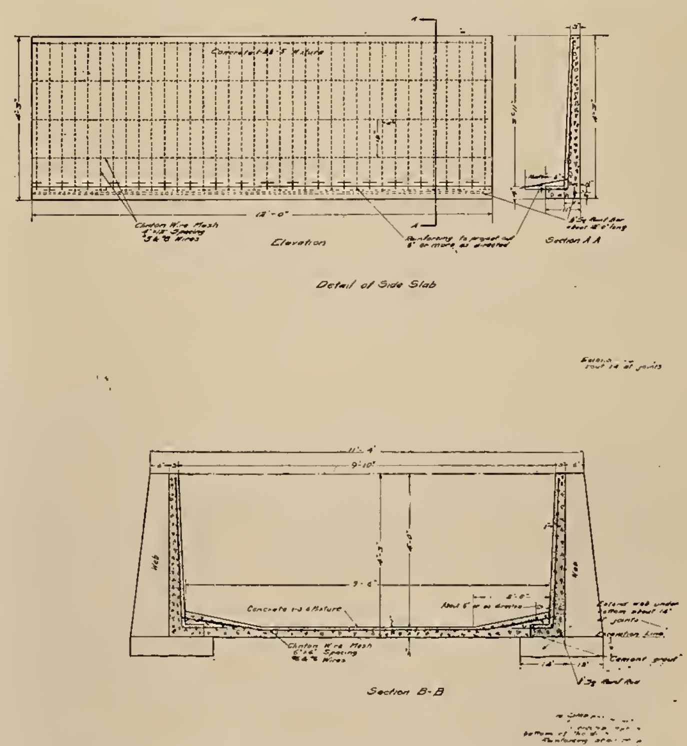
Storage Requirement.

The annual distribution of load upon the power houses of this system is peculiar, owing to the nature of the demand for power. As in all California watersheds, the maximum flow occurs during the period of melting snow in the high mountains. This diminishes through summer until September, when the flow becomes a minimum. It has already been explained in this article that this minimum flow is particularly severe within the watersheds of the Kaweah and Tule Rivers, for the reason that the ground reservoiring is small, due to the almost complete exposed rock surface, and very limited timber covering.

This company's principal load is pumping for irrigation. This commences in the early spring when there is an ample supply of water for power. The pumping continues until well into the autumn of the year, and overlaps a portion of the low water period. The irrigation load, however, decreases to a large extent some time before the period of minimum flow from the watersheds.

It has been the custom since the construction of the steam plant at Visalia to supply a certain amount of power during the early part of the low water season, to make up the amount necessary for load requirements, which could not be supplied from the hydraulic plants. This contribution from the steam plant has been relatively small, but nevertheless an important item for consideration.

In order to obviate the use of steam by the operation of the hydraulic plants, it has been necessary to supply storage in the mountains, to make up the flow of water necessary over and above the minimum flow available. In most California plants this storage flow would be required to cover the sag in the curve of natural water flow over the entire low water period, due to the conditions already outlined. It is not necessary in this system to maintain so great a flow over this minimum period, nor to continue this flow at its full initial volume. A very careful study of load curves with reference to the stream flow of the Kaweah River, and particularly with reference to the plants Nos. 2 and 3, and eventually No. 5, have resulted in showing that a flow from storage of 50 second ft. to October 1st, which can then be diminished to 25 second ft. for the balance of the low water season, will give sufficient power to satisfy the requirements of the distribution service over the most severe year of which there is any record. This provision will also take care of the future requirement covering these conditions for many years, assuming the



Cross Section of No. 3 Conduit for Bench Construction.

completion of Plant No. 5, and also prevent the necessity of operating the steam plant except as an emergency standby.

The storage capacity of the Wolverton reservoir is sufficient to supply a flow from storage of 50 second ft. for a period of 32 days, or a mean flow of 25 second ft. for twice as long a period. This will meet the demand which it is estimated will be necessary and will greatly increase the yearly kilowatt output of the hydraulic plants, with an accompanying increase in earnings without any additional outlay for plant capacity.

A Typical Section of Slab Bench Construction, Showing Method of Crossing a Depression.

Wolverton Reservoir.—On the Middle and Marble Forks of the Kaweah River, there are also a number of small lakes, but these are not considered of value in connection with this system. The company has recently commenced construction of a storage reservoir on Wolverton. Creek, which will be known as the Wolverton Reservoir. This basin, which has a heavy timber covering, while it is not of very great extent, will give sufficient storage to make up for the lack of power at low water. This reservoir has a dam of the rock filled type, 725 ft. long on the crest, 125 ft. wide at its widest point of the base, and with a maximum height of 90 ft. The down-stream face has a compound slope, the lower half being 1¼:1, while the upper half is 1:1. The up-stream face has a uniform batter of 1 ft. in 5 ft. vertical. This face has a rubble masonry lining 3 ft. thick, on which is placed a plank facing. Through the lowest point of the dam are two 28 in. diameter steel outlet pipes, which are embedded in concrete. There are two gate valves in each pipe line, one at the upper toe operated by a hand wheel on the top of the dam, while the other is at the lower toe, and is housed in a small masonry compartment to prevent freezing in the winter. The gate valves of the outlet pipes at the upper toe of the dam are protected by a trash rack, made of 3x½ in. flat steel bars, placed on edge, and spaced 2 in. centers. There is at one end of the dam a concrete spillway. The capacity of the reservoir will be 150,000,000 cu. ft., equal to 3430 acre ft. The elevation of the dam is over 7200 ft. This work is being constructed under contract by J. G. White and Company.

There is another available reservoir site on the Marble Fork watershed, this will be the object for future development.

Power Plants of Kaweah System.

Kaweah No. 1 is served by a pressure pipe 3300 ft. long. The grade of this line is exceptionally rough and steep, and was considered at the time of its installation as a singularly difficult piece of work. There are no lateral bends and the slope has at places a grade of 100 per cent or 45 degrees. These slopes, however, constantly vary, so that there are many vertical bends.

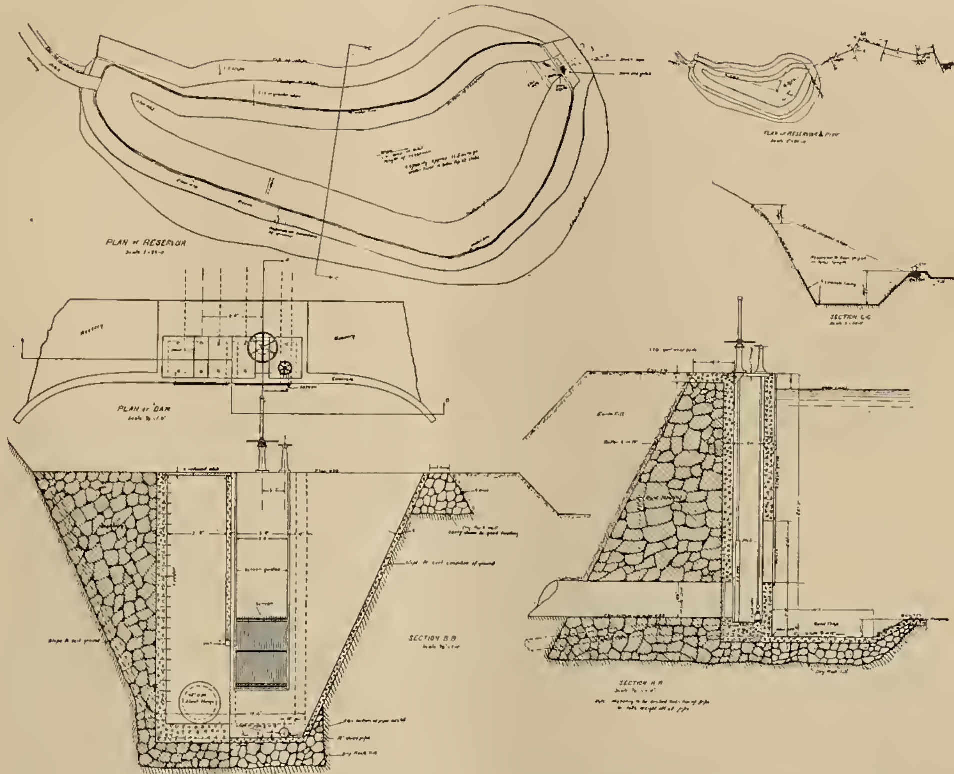
The pipe has a diameter at the top of 24 in., and the thickness is No. 12 B. W. G., with a lap-riveted

Views From Opposite Directions, of the No. 3 Forebay Reservoir, Approaching Completion.

construction. As the pipe descends, the diameter decreases to 23, 22, 21, and finally to 20 in., of which diameter the last 1160 ft. is in lap welded pipe. The thickness at the power house is ½ in. The pipe line terminates with a section parallel to the power house building, in which are placed 3 cast steel branch fittings. From these, connection is made to each water wheel nozzle. For a distance of 400 ft. above the power house the pipe is anchored in a block of concrete, and throughout its length there are concrete anchors built into bedrock. The static head on this line is 1310 ft.

inghouse type. These are equipped with the conventional instruments and remote control for the three General Electric K-2 oil switches.

The transformer equipment consists of four Westinghouse oil-insulated and self-cooled raising transformers, each having a capacity of 500 kw. The oil is additionally cooled by being pumped from the cases through an exterior cooling coil, from which it is returned to the cases. The transformers are wound for 440 volts primary, and 20,000 volts secondary. This is "Y" connected to give a high tension voltage of 34,600. Each transformer is housed



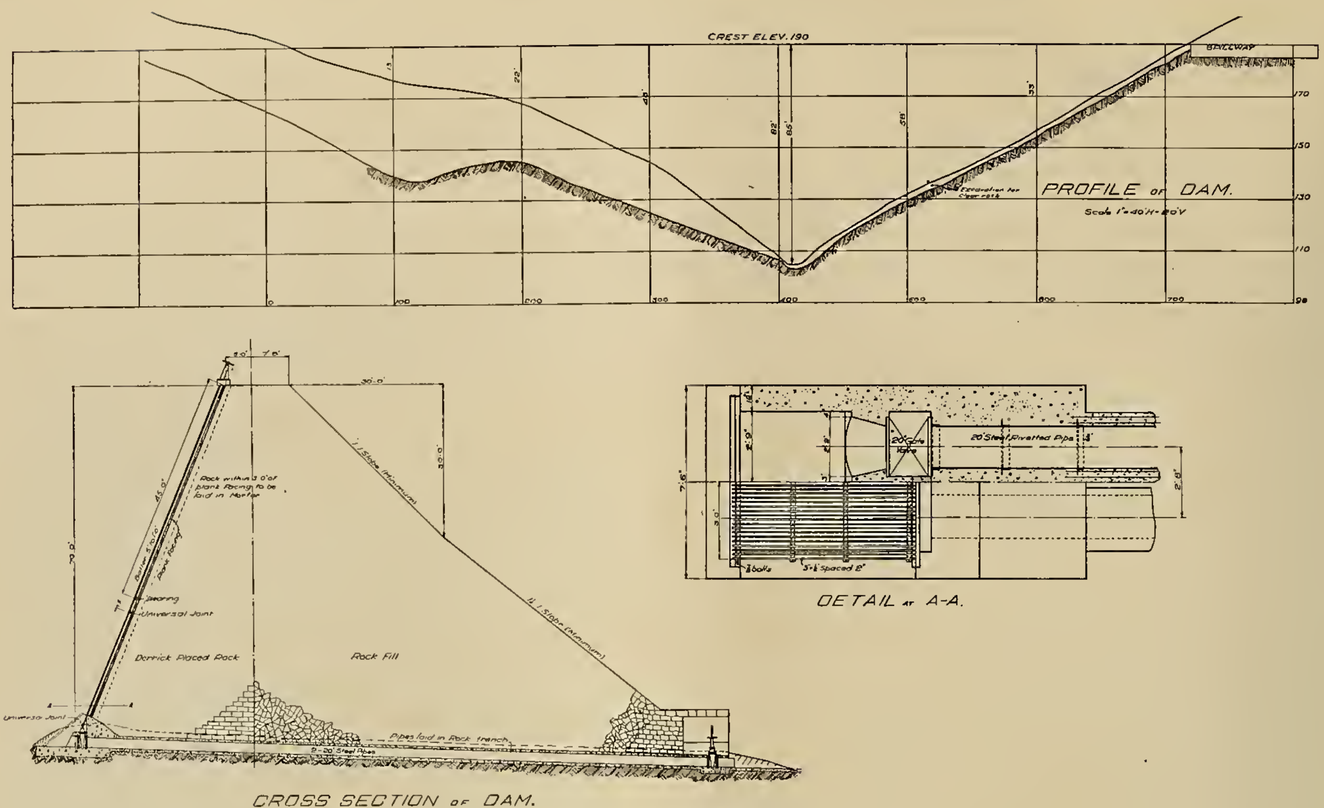
Plan and Cross Sections of No. 3 Forebay Reservoir.

in a separate small brick building and is mounted on a low structural steel car, which may be hauled out of the building, and placed upon a transfer car, which operates on a track passing the front of the transformer houses and parallel to the power house. In a separate building is a small machine shop and an ice plant. During the summer months the heat in this canyon becomes intense, and ice is made here for the convenience of those who live at the plant, as well as for the two other plants in this canyon. Incidentally, a small amount of ice is sold and distributed among the neighboring ranches, above and below the power plant. The discharge water from this plant flows into the Kaweah River, and is not again used.

The power house is on the south bank of the Kaweah River, about two miles below the junction of the Middle and East Forks. This plant, which was the first of the system, was built in 1899 and follows a practice of construction in vogue at the time. The power house building is 50 ft. long and 30 ft. wide, and is constructed of galvanized corrugated iron. Within the building are three main generating units and two exciter units. The generators are Westinghouse 3-phase, 450 kw., revolving armature machines, operating at 450 r.p.m. The water wheels are contained in a cast iron housing, and consist of a single overhung runner. Originally this was a Doble equipment, but has from time to time undergone various changes, when different makers have experimented with their particular type of bucket, in order to improve the efficiency of the apparatus. Two of these units are operated with straight nozzles, while the third is equipped with a needle nozzle. The exciters, which are rated at 15 kw., operate at 1050 r.p.m., and are driven by belts from pulleys on the generator shafts. Each exciter has sufficient capacity for all three generators.

The switchboard has six marble panels of West-

Kaweah No. 2 Power House is across the river from the No. 1 plant, and about a mile below it. It is the second of the plants, having been constructed in 1904-5, and put in operation in February of the latter year. This is the only plant on this system that may be termed a low-head installation, the static head of the pipe-line being 351 ft. This pipe takes a direct course from the concrete headbox at the end of the canal line. There are five hand-operated sluice



Profile and Cross Section of the Wolverton Dam.

gates, 2 ft. 5½ in. wide by 6 ft. 6 in. high, set in a concrete wall, to control admission of water into the pipe. The pipe-line has a total length of 1000 ft., and a single diameter of 40 in. As at the No. 1 plant, the pipe parallels one side of the power house and is supported on steel "I" beams, over the tail-race. There are three branches in this final section of the pipe, which supply water to the three generating units, originally installed in the plant. The final section of the pipe, from which the connection to the last unit is made, has a diameter of 34 in.

The power house is a corrugated iron building, 59½ ft. long and 32¼ ft. wide and contains the generating units and switchboard only. Originally this building contained three main generating units. These each had a capacity of 500 kw. Two of these units have been removed, while the third still remains in use. This is a General Electric 500 kw., 2300 volt, 3-phase revolving field generator, operating at a speed of 450 r.p.m. It is direct-connected to a Victor Girard type turbine, controlled by an hydraulic-operated gate valve. One of the other units has been replaced by a new generating unit of 1500 k.v.a. capacity. This unit is of sufficient size to handle all of the water available in the canal system. The generator is General Electric, 2300-volt, 3-phase, operating at 720 r.p.m. It is direct-connected to a Pelton-Francis turbine, having a capacity of 2250 h.p. This water wheel has a runner 32 in. in diameter, and is equipped with a Lombard type "Q" governor.

There are two General Electric 4-pole, 125 volt, 30 kw. exciters, which operate at 1050 r.p.m. These are direct-connected and driven by Platt Iron Works Girard type turbines.

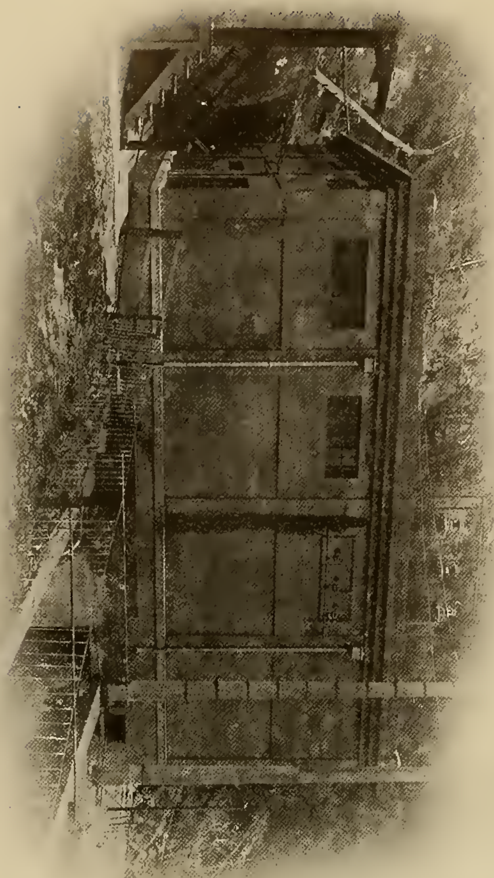
To prevent shocks in the pipe line, there is an equipment of two Lombard 8 in. relief valves. The switchboard contains six marble panels, of which three control generators, one the exciters, and two are feeder panels. Each generator panel has mechanical remote control for two General Electric K-12 oil switches. There are 3 ammeters, and one volt meter. The exciter panels each contain two Thompson astatic ammeters, and 2 volt meters of similar type. On the remaining two panels are a General Electric polyphase integrating watt-meter and 8 controls for transformer switches. In a room at the rear of the switchboard is one 3-pole horizontal break Stanley rotary, 35,000 volt oil circuit breaker. These switches are mounted in slate tanks. Adjoining the power house is a long concrete building, in which are placed seven Stanley G. I. 350 kw. oil insulated raising transformers. These are wound for voltage of 2300 to 20,800, to be "Y" connected on the high tension side for the transmission voltage of 35,000. These transformers are mounted on low structural steel cars, which may be rolled out of the building on to a transfer car. The building is divided by transverse walls, so that each transformer occupies a cell of its own. Cooling is accomplished by circulating the oil from the transformers through a coil of 2 in. pipes, which is mounted in the tail-race. A water spray over this coil serves to carry away the heat of the circulating oil.

Kaweah No. 3 Power House has for the present a single pressure pipe line. It is proposed in the near future to duplicate this line, as there will be an additional supply of water available during the period of low water flow, due to the storage in the Wolverton reservoir. The present line receives the water directly from the end of the concrete flume, through a pair of sluice gates, and a set of trash racks. The line

runs 839 ft. on a horizontal grade along the hillside and outside of the forebay reservoir. This horizontal section terminates at a stand pipe of the same diameter as the pipe. Beyond the stand pipe the line makes an abrupt turn to follow the slope of the hill to the power house. As soon as the forebay reservoir shall be completed, which will be about the first of the coming year, a part of this horizontal section of the pressure pipe 596 ft. long will be discontinued, and the intake will be from the forebay reservoir direct. The total length of the pressure pipe is 2589.93 ft. It is built throughout of riveted sheet steel, and has a diameter at the top of 42 in., with a thickness of plate of 3/16 in. As the pipe passes down the hillside the diameter is reduced to 40 in., then to 38 in., and finally to 36 in., at which size it enters the power house. The thickness at the power house is ⅝ in. The total static head is 776 ft. The pipe line is laid in a trench, and has a back filling of earth, and wherever there is a vertical angle, there has been placed an anchor of reinforced concrete. Manholes are provided at a number of points along the line. At the power house the pipe terminates in a cast steel Y. This is embedded in a block of concrete, carried to bedrock.

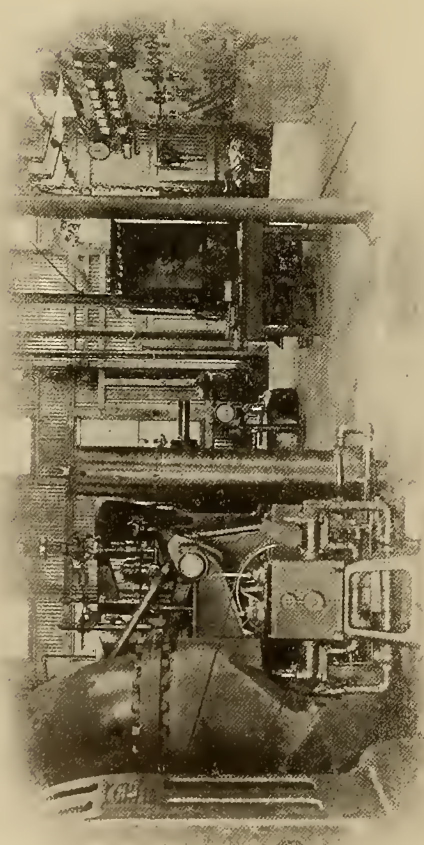
(1) Interior Kaweah No. 1 Power House.
(2) Intake Dam, Showing Tunnel and Wasteway Kaweah No. 1 System.
(3) End of Kaweah No. 1 Flume, Showing Sandbox.

The power house is a reinforced concrete building 50x50 ft. inside measurement. It is divided by a transverse wall into a main operating room, a transformer and a high tension section. The main operating room is 50 ft. long by 34 ft. 4 in. wide. The transverse wall is of solid concrete 8 inches thick, and the building walls are of the same material and thickness. Running the long way of the operating room is a Cyclops hand-operated, traveling crane, with a capacity of 30,000 lb. The windows are ample, and are glazed with translucent wire glass set in metal frames. The building is fireproof. The two main generating units are arranged right and left-handed, so that the water wheel ends face each other. The main generators are rated at 1750 k.v.a., and deliver 3-phase current at 2300 volts, and have a speed of 300 r.p.m. The water wheels have each a single runner, are mounted on the end of the generator shaft, and are enclosed in a cast iron housing. The supply of water for each unit passes from each branch of the Y at the end of the pipe line, through hydraulically operated gate valves, and thence to the needle nozzles, with which the water wheels are equipped. These nozzles have auxiliary by-pass nozzles, which operate in connection with the main needles from the



Kaweah No. 3 Power House.

Kaweah No. 1 Power House.



Interior Kaweah No. 2 Power House.

The Tule Power House.

governor. The action is such that as the water is shut off from the main nozzle, the by-pass needle automatically opens with a time element lag, to prevent shock on the pipe line, and then gradually closes for the purpose of saving water. Pelton automatic oil pressure governors are provided, and the entire hydraulic equipment was furnished by the Pelton Water Wheel Company, and was built under Doble patents. There is placed in the main pipe line, just outside of the building, as an additional safeguard against shock from sudden shutting off of water, a Lombard relief valve.

are equipped with volt meter, ammeter, wattmeter, power-factor meter, d.c. ammeter and rheostat control. The fourth panel contains a General Electric type T. A. voltage regulator, and the oil switch control and starter for the induction motor exciter set. The fifth panel controls the two exciter generators. Half of the remainder of the building contains the transformers, of which there are four. These are rated at 1250 k.v.a. The low tension winding is 2300 volts to 20,200 on the high tension side, the latter being star-connected for transmission at 35,000 volts. These transformers are oil-insulated and

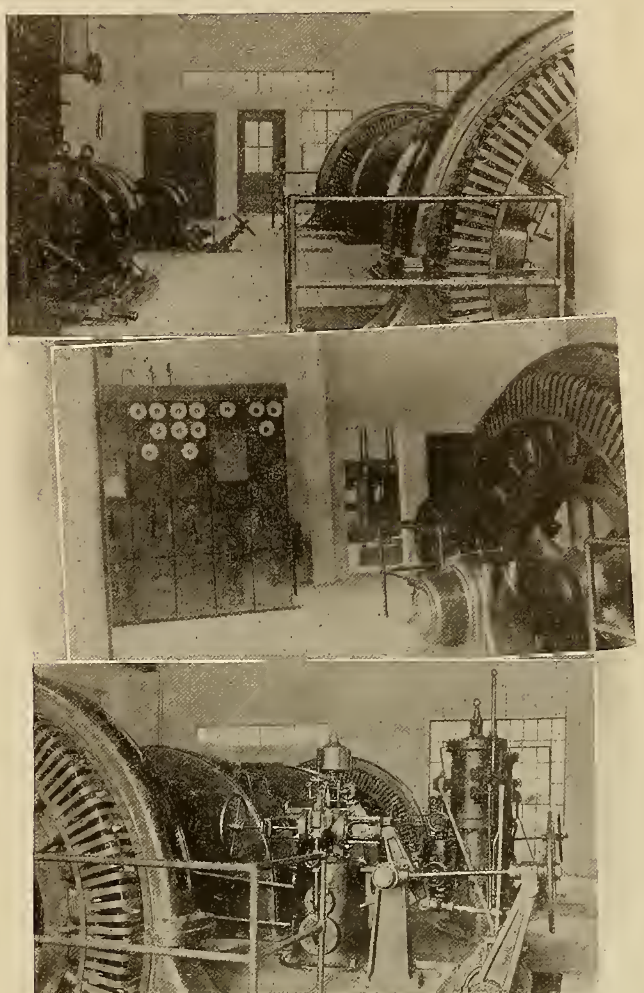
(1) Kaweah No. 2 Power House.
(2) Receiver of Kaweah No. 2 Pipe Line; Also Showing Coils for Cooling Transformer Oil and Its Spray System.
(3) Concrete Lined Canal, Kaweah No. 2 Plant.

water-cooled. The remaining section of the building is devoted to the high tension switching apparatus. This, for the present, consists of one 3-pole set of type "E" 35,000 volt Westinghouse oil circuit breakers. After leaving the high tension switch, the line passes through a set of inverted disconnecting switches, thence through choke coils, thence a second set of disconnecting switches, and then passes to the transmission line through 30 in. square openings in the wall of the building. These are fitted with two glass panes, having 6 in. holes at their centers. In the high tension compartment are one 50 kw. General Electric 2300 volt station transformer, and two 5 kw. transformers of the same make and size for local lighting and power service. Placed near the exciters is a small pumping set consisting of a 2 in. 2-stage

There are two exciter units. The generators of these are similar, each having a rating of 55 kw., and operating at 850 r.p.m. These supply direct current for excitation at 125 volts. One of these units is driven by an 82 h.p., 2300 volt, induction motor. This set has but two bearings, and is mounted on a cast iron bed plate. The second exciter is driven by a Doble water wheel, equipped with a hand-regulated needle nozzle. This is likewise a two-bearing set, mounted on a cast iron bed plate.

The switchboard in one corner of the operating room consists of five panels. The first controls a transmission line, and on it are mounted one graphic recording watt meter, one 2300 volt remote control circuit breaker, and two overload relays. The second and third panels control the generator output, and

centrifugal pump, driven by a General Electric 5 h.p. 110 volt motor at 1800 r.p.m, and used for circulating transformer oil. A sound-proof telephone booth is placed against the end wall of the building near the switchboard. Upon the roof is mounted one set of Westinghouse aluminum cell electrolytic lightning arresters.



Interior Views of Kaweah No 3 Power House.

The entire electrical equipment except when otherwise noted was furnished by the Westinghouse Electric & Manufacturing Company.

In the construction of the pipe line and forebay reservoir, a tramway was built, which starts a short distance below the power house, and after mounting the steep hillside for several hundred feet, meets the pipe line and then follows it to the top. This tramway is operated by a 2-cylinder, 3-drum Mundy hoisting engine, by means of a 7/8 in. steel rope. There is also at this point an air compressor plant consisting of two Giant compressors, driven by one Westinghouse 10 h.p. and one 20 h.p. induction motors.

The Tule River Power System.

The second and more southerly watershed and its accompanying power system is on the North and South Forks of the Middle Fork of the Tule River, the next river of importance south of the Kaweah. Its watershed has an area of 88 square miles above the points of diversion of the power canal and lies between the west slope of the ridge which separates the Kern River from the San Joaquin Valley. The drop of the stream beds is unusually rapid, and the watershed is rugged. A few small lakes in the upper regions of the watershed have not been improved for use with this system.

There are two diversions, one from each fork, each being but a short distance above the junction. The diversion in the North Fork at present consists of a small masonry dam at a point where the stream bed provides a natural place of intake for the canal. There is here a set of three sluice gates at the west end of the dam, and a wood flume commences immediately at the outlet of these gates. This diversion is being reconstructed by placing a concrete dam about 200 ft. below the present dam, and at a slightly lower elevation. From this new diversion a new flume is being constructed to the junction point. The distance from the present diversion to the junction with the main canal is 673 ft.

The diversion in the South Fork is formed by means of a low masonry dam, having a concrete spillway at the south end, and an intake similar to that at the North Fork diversion, consisting of a pair of sluice gates at the north end of the dam. Water diverted through these gates passes into a rectangular concrete lined ditch, built on a bench in the hillside. This joins a flume which forms the beginning of the main conduit. The distance from the South Fork intake to the junction with the North Fork flume is 577 ft.

The main conduit follows the north slope of the Tule River canyon to a point where the river makes a bend to the north. The ground surface followed by the conduit line is extremely rugged. The line itself is composed of 23,600 ft. of wooden flume, 11,206 ft. of concrete lined ditch, and 228 ft. of concrete flume. The total length of the conduit is 36,417 ft. or 6.9 miles.

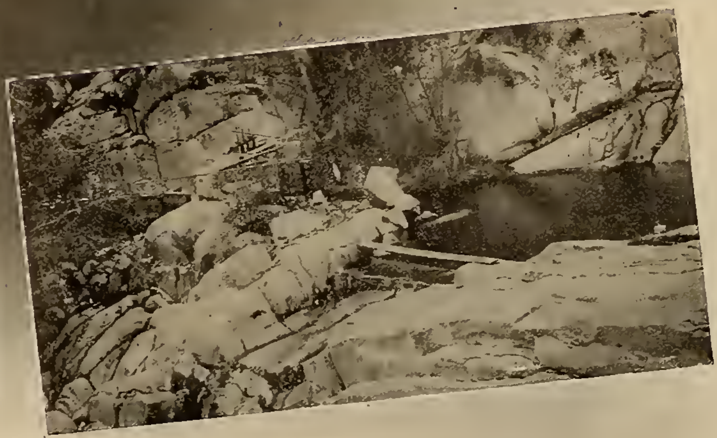
The wooden flume is of the conventional type found throughout the mountains in California. It is 4 ft. wide and 3 ft. deep, and is laid on a grade of 2 ft. in 1000. It is built of pine lumber, and in many cases is supported on high trestles.

Where possible the conduit is in ditch, concrete lined. The ditch section has a width of 4½ ft. on the bottom, 10½ ft. across the top, and is 3 ft. deep. The grade of the ditch sections is one foot in 1000, or half that of the flume sections. The concrete lining has a thickness of 3 in., of which ½ in. is a plaster covering.

In the line is one inverted siphon 879 ft. long of lap riveted steel pipe 1/8 in. thickness and 36 in. in diameter. The maximum head on the siphon is 120 ft. The several sand-boxes, consisting of enlargements in the concrete lined ditch section in which the bottom is somewhat lower than the bottom of the incoming ditch, are provided with sand gates.

At the terminus of the canal line is a small regulating reservoir with a capacity of 175,000 cu. ft. and varies in width from 12 to 125 ft. The length is 302½ ft. and the side slopes are ½ to 1. The lining of this reservoir is heavier than in the ditch sections, being 8½ in., which includes the plaster coating. At the entrance of this reservoir is a sand-trap 12 ft. deep.

The pressure pipe line to the power house enters the forebay reservoir, and is carried from the reser-



(1) South Fork Diversion Into the Tule Power System Canal (2) North Fork Diversion Head-Gates.
(3) New North Fork Diversion, Showing Concrete Dam. (4) North Fork Diversion and Dam.

voir directly down the hillside to the power house. This pipe has a diameter of 30 in. at the top, with a plate thickness of No. 11 B. W. G. Ths diameter decreases to 28 in., thence to 26, and finally enters the power house at 24 in., with a thickness of plate of 9/16 in. The total length of the pipe is 2814.8 ft. The static head is 1130 ft. Throughout, the pipe is laid in a trench, and is covered with a back filling of earth.

Tule Power House.

The Tule plant was built in 1908-9, and commenced operations in September of the latter year. The power plant is in two buildings, in which the generators and transformers are contained in the larger; and the high tension switching apparatus, in the smaller building. Both are steel frame structures, and have reinforced concrete curtain walls. The main building is 39x30 ft., and has a corrugated hip roof with monitor running the full length. Against one side of the building is a lean-to addition, which increases the width of the building by 14 ft. 9 in., in which are placed the transformers. There are two main generating units. These each have a capacity of 1000 kw. They are General Electric type A. T. B. 2300 volt, 3-phase revolving field machines, operating at 514 r.p.m. The water wheels consist of a single runner mounted in cast iron housing, on the end of the generator shaft. These are Doble wheels, and are rated at 1800 h.p. each. Automatic needle bypass nozzles form a part of the equipment, and these are controlled by Lombard type K governors.

The pressure pipe enters the building below the floor line, at the center and in the rear. It immediately branches through a cast steel Y, and on both ends of this branch are two hydraulic-operated gate valves. From these the nozzle fittings are carried into the water wheel housing. The discharge from the water wheels passes through tunnels to a point outside of the building, from which it is led into a ditch, which carries the water up stream in reference to the direction of the Tule River, for a distance of about ½ mile, and there discharges into the river. This was necessary on account of the use of water by other appropriators. The power house is therefore, not placed at the lowest possible point with reference to the river.

Of the two exciter units the generators are General Electric 35 kw., 125 volt, d.c. machines, which operate at 1200 r.p.m. One of these exciters is driven by a 60 h.p. General Electric induction motor, while the other has a Doble water wheel, overhung at one end of the generator shaft.

The switchboard is placed at the center of one side of the building, facing the generators, and opposite to the incoming pipe line. This equipment, furnished by the General Electric Company, is in polished black slate in 5 panels, the first being devoted to the control of the exciters, mounting Thompson astatic instruments and rheostat controls, and a totaling polyphase watt meter. The second panel has a General Electric type T. A. voltage regulator. The third and fourth panels are devoted to the generator control, and contain ammeters and volt meters, and

Interior of Tule Power House.

time limit relays, together with power factor indicators and watt meters. The fifth panel controls the

Views on Tule Canal System.
(1) Junction of Concrete Lined Canal and Wooden Flume.
(2) Enlarged Section of Canal, Containing a Sandbox.
(3) View Looking at Flume From Below.

transmission line switches, and has one indicating watt meter, two time limit relays and remote control for two transformer switches. This panel also contains a synchroscope.

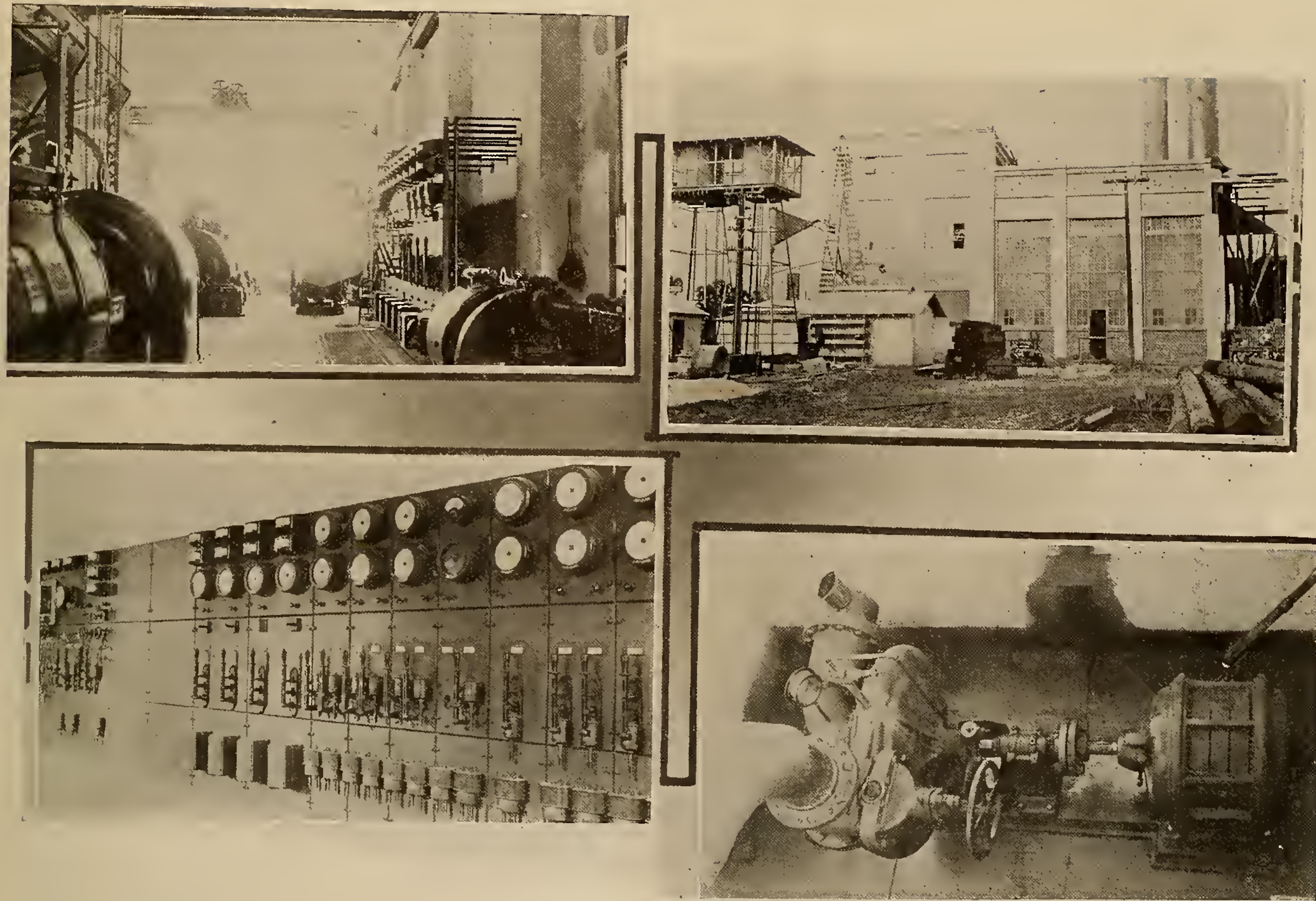
The transformers, which are separated from the main room of the power house by a concrete wall, consist of two banks of 3 General Electric, 400 kw. water-cooled transformers, wound for a primary voltage of 2300, and a secondary voltage of 20,400, and are delta connected on the low tension side, and star connected on the high tension side, to give 35,000 volts for the transmission line. In the second building, which is devoted to the high tension switching apparatus, there is one set of 35,000 volt General Electric aluminum cell lightning arresters. This switch house is arranged with cells in two groups for three incoming high tension lines from the transformers, and one outgoing line.

Disconnecting switches are provided and one main line 35,000 volt Kelman circuit breaker is installed here. On a pole structure outside of this building is a set of line disconnecting switches.

Visalia Steam Plant.

For seven years, after commencing operations, this system depended entirely upon the power received from its hydraulic stations. As the business and load increased, it was found advisable to install a steam auxiliary plant, both for the purpose of supplying power in case of emergency, where there might be an accident in the transmission system, or during periods of extreme low water in the mountains. Work was commenced in 1905 on a steam station in the city of Visalia, and this plant was completed in August, 1906.

The first installation had a single generating unit of 1000 kw. capacity. In 1912 the capacity of the plant was increased by the addition of a second steam turbine and additional boilers. During 1913 a further increase has been made by the addition of a third



Views at Visalia Steam Plant.
(1) Turbine Room, Looking Toward New Addition. (2) Rear View of Power Plant, Showing New Construction.
(3) The Switchboard. (4) One of the Water Supply Pumps in the Bottom of a Pit.

turbo-generating unit. The transformer substation for Visalia is also at this point.

The plant consists of two two-story structures. One of these is the transformer station, and contains the high tension switching apparatus. On the lower floor of this building are housed the transformers. This section is 43½ ft. long by 24½ ft. wide. The Visalia distribution has both 2-phase and 3-phase circuits, so that the transformer connectons are made to supply this demand.

Of the transformer equipment there are four Allis-Chalmers 500 kw. transformers. One of these is a spare for use in case of emergency. These transformers are wound for 19,050 volts on the primary side, and 2300 on the secondary. They are star-connected on the high tension side for the 34,000 volt transmission connections. On the low side they are delta-connected with a center connection in one of the transformers, in which is inserted a 50 kw. booster. This is for the purpose of supplying a 2-phase secondary circuit. There is a second set of four 350 k.v.a. Westinghouse transformers, one being a spare. These are star-connected on the high tension side, but on the low tension side are delta-connected to give three single-phase circuits. This is for lighting service in the city of Visalia. The Allis-Chalmers transformers are oil-immersed and water-cooled. From the Westinghouse transformers the oil is circulated through an old transformer tank. In this tank is a coil of 30 turns of 1 in. copper pipe, and the cooling water is circulated through this coil. By this means the oil temperature is not allowed to go above 105 degrees F. in winter, or 110 degrees F. in summer. A 3 h.p. 3-phase induction motor drives a 2 in. Price centrifugal pump. This rig is used for circulating transformer oil.

To accommodate the increased capacity of the steam station, there are being installed three 2500 k.v.a. Allis-Chalmers water-cooled transformers, wound for 33,000 to 2200 volts and to be delta-connected on both sides.

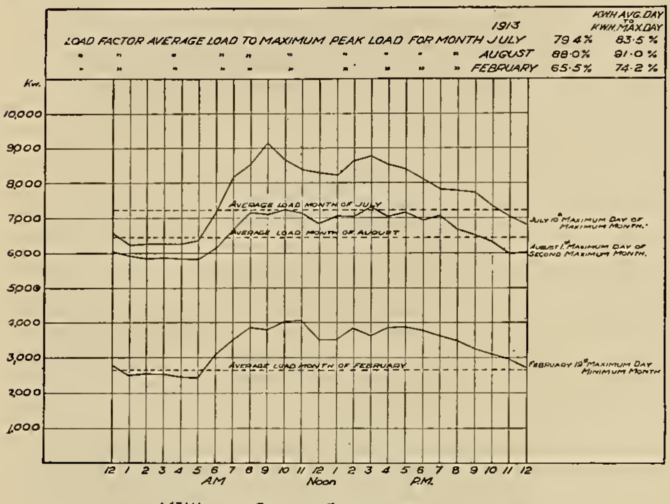
Each of the two 6.6 ampere mercury arc rectifiers has a capacity of 75 lights, and supplies the current for the street lighting system in Visalia. In connection with these rectifiers are two General Electric arc transformers with a primary voltage of 2200 and a rectified voltage of 6750. The rectifiers contain both heating and cooling coils and a small motor for circulating oil.

A synchronous condenser was found necessary to improve the load factor on the system, and is of great value in that connection. This machine is a General Electric 3-phase, 500 kw., 2300 volt, synchronous motor, operating at 450 r.p.m., belt driven by a 50 h.p., 2200 volt General Electric induction starting motor. By the use of this condenser it is possible to raise the power factor on the system about 20 per cent and bring its value at the power houses to about 90 per cent. There is here also a standard General Electric 7 in. oil filter and purifier, having a capacity of 6 gal. per minute.

On the second floor over the transformer room

are two compartments, one containing the bus lines, and 2300 volt, low tension oil switches from the generator feeders, the other room containing the 34,000 volt incoming and outgoing line switches and disconnectors.

The two incoming high tension circuits enter through roof insulators. The third circuit leads to the transformers underneath. Of the incoming circuits, one is from the power plants; the second is a circuit connecting into the network, known as the west side line, and leaves this station, passing southward to Tulare, Tipton and Delano. The incoming lines pass through disconnectors, thence through a set of General Electric K-21 oil circuit breakers, thence through a second set of disconnectors to a bus line. The oil circuit breakers and connections are all mounted between concrete barriers. The conductors are ¾ in. copper tubing. Upon either end of the bus line are disconnectors, and from these the circuit is carried in one instance, through a set of circuit breakers similar to those described, and thence to the outgoing transmission line. The transformer connections are made in a similar manner from the other end of the bus line. This room will be extended to accommodate new equipment in the near future, as the requirement of the business may dictate.



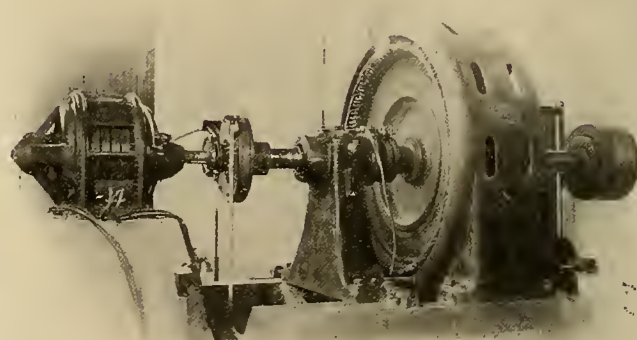
Typical Load Curves, Mount Whitney System.

The main building contains in the front part, a machine shop on the first floor, and sleeping rooms for operators on the second. In the rear of this building is the generating room, which is on a level with the second floor. The old generating equipment consisted of one Westinghouse-Parsons turbo-generator, having a capacity of 1000 kw., and operating at 1800 r.p.m. The second machine is a General Electric Curtis 2-stage turbo-generator, having a capacity of 750 kw. at 80 per cent power factor, and operating at 3600 r.p.m. The turbine is equipped with mechanical valves. Both of these machines deliver 3-phase current at 2300 volts. The third turbine occupies a continuation of the old generating room space. This continuation, however, is in a new type of building, having a reinforced concrete frame, with brick curtain walls. It is proposed to increase the width of the old generating room to correspond with the new section, and to make this entire part of the building uniform. The new section is 36 ft. long and the outer end has a temporary metal lath and plaster wall, so that a still further extension may be made. The present total length of the generating room is 100 ft. The new turbine is a Westinghouse-Parsons double flow type, and has a rated capacity of 5000 k.v.a. All of the main unit steam equipment operates at a steam pressure of 175 lb. per sq. in., and all of it is condensing.

The exciters consist of one General Electric 50 kw. 4-pole and interpole machine, operating at 1200 r.p.m., driven by a General Electric induction motor of 75 h.p. capacity. This set is mounted on a cast iron base, and has three bearings. The second exciter set consists of a Curtis turbo-generator operating at 3600 r.p.m. Its capacity is 25 kw., and the generator has two poles, with interpoles. The turbine operates non-condensing.

The switchboard for the plant is placed about the center of the generating room, close to one wall. It is in 9 panels, of which the first controls the exciters, the second has a T. H. voltage regulator, also the remote control switch connections for two transformers. The third panel contains the control for the new 5000 k.v.a. generator. The fourth and fifth control the first two turbo-generators, and the last four panels control three 3-phase 2300 volt circuits, and one 2-phase 2300 volt circuit. Operating throughout the length of the generating room is a Whiting hand-operated traveling crane, having a capacity of 20 tons.

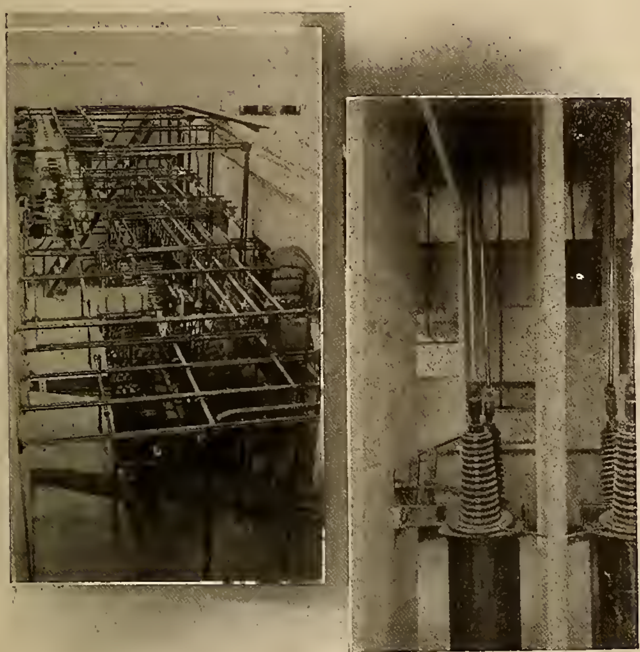
Of the auxiliaries on the main generator floor there is one Worthington tandem vacuum pump 6x12x12 in. and one Wheeler opposed vacuum pump 6x14x10 in.


Synchronous Condenser, Starting Motor and Magnetic Clutch at Lindsay Substation.

Adjoining the generating room, parallel to it, but on the ground floor, are four Stirling Class "Q" 302 h.p. boilers. These each contain 273, 3¼ in. tubes, three 42 in. steam drums, and one mud drum of the same size, each equipped with two Hammil oil burners. Placed in an L in the new section of the building is one Stirling boiler, having a capacity of 604 h.p. This boiler contains 440, 3½ in. tubes, three 42 in. steam drums and one 48 in. mud drum, and has three oil burners. Three more boilers similar in type and size are ordered and are to be placed in the near future.

Of the auxiliaries there are two Smith-Vaile steam pumps for fuel oil. These are 6x4x6 in. In this connection there is a Berryman-Patterson feed water

heater, used as an oil heater. Each turbine has its own condenser. The 750 kw. machine is equipped with a Wheeler jet condenser. The 1000 kw. turbine has a Worthington surface condenser, containing 3600 sq. ft. of cooling surface. The new 5000 k.v.a. turbine is equipped with a Worthington-Leblanc condenser. The feed water pumps consist of two Worthington 10x5½x10 in., and one Smith-Vaile 10x5x10 in. steam pumps. There is one 2-stage 2 in. Worthington centrifugal pump, driven by a 3-phase 5 h.p. General Electric motor, which drains the surface condenser. There is one G. W. Price 10 in. centrifugal pump, driven by a 50 h.p. Westinghouse induction motor,



(1) Rear of Switchboard, Lindsay Substation.
(2) A Pair of 35,000-Volt Circuit Breakers, Showing Cells and Bus Lines.

which supplies water both to the surface condenser and to the cooling tower. For the jet condenser a 25 h.p. Kerr steam turbine, operating at 1500 r. p. m. is connected to an 8 in. Wheeler centrifugal pump. The circulating water is pumped from wells into a large reservoir, from which it is drawn for use. The heated water is returned through a spray system to this reservoir, and is allowed to cool by the effect of evaporation. The loss by evaporation is made up by additional pumping. This makeup water is handled by a G. W. Price 5 in. centrifugal pump, driven by a 10 h.p Westinghouse induction motor. The last pumping installation in the power house consists of a pair of Terry steam turbines direct connected to Platt Iron Works No. 4, 3-stage centrifugal pumps, operating to 520 ft. head, at 2800 r.p.m. These supply feed water to the new boilers.

Water for this plant is obtained from six wells, which have an average depth of 80 ft., and a diameter of 12 in. There are two pumping rigs, each pumping from three wells. In each pump house is a high duty 8 in. centrifugal pump, driven by a 25 h.p. induction motor at 900 r.p.m.

A third pumping unit consists of two 2 in. Price centrifugal pumps, driven by 3 h.p. 2200-volt motors, which is used exclusively for station supply, sealing the turbines, etc. At one corner of the property, reached by a spur from the line of the Southern Pacific are two steel fuel oil tanks, having a capacity each, of 750 bbl., and a third tank, with a capacity of 3000 bbl. There are also two elevated water tanks, each with a capacity of 3000 gal. for general station supply.

The system for cooling circulating water, which has been in use at this plant, has been of the gravity tower type. In many respects, this has not proven satisfactory, and recently a new spray system has been installed. Adjoining the power house, and within the company's property, a large rectangular pond was constructed by excavation. This has a length of 168 ft., a width of 120 ft., and is about 3 ft. deep. The pond has a lining of reinforced concrete. Over the pond are mounted several groups of spray nozzles, through which the circulating water from the condensers is discharged. The nozzles are so designed and located with reference to one another, that the water issues from them in the form of fine spray, which assists in the evaporation, and hence the cooling of the water below the temperature of the air. This system is designed to cool 10,000 gal. of fresh circulating water per min., reducing the temperature from that of the condensed discharge of 110 degrees to 85 degrees F. when the surrounding air is 100 degrees F., with a 25 per cent relative humidity. This is the first large installment of a spray pond cooling system on the Pacific Coast, and is expected to give favorable results notwithstanding the extreme climatic conditions of the San Joaquin Valley. It has been designed and installed by Charles C. Moore & Company, Engineers, of San Francisco, in connection with other extensive construction work, which they have recently done on this plant.

Power Output.—The power output of the four hydroelectric plants and the steam standby station, in terms of horsepower, has a maximum aggregate based on the ratings of installed generating machinery of 19,600 h.p. The overload capacity for which the hydraulic systems and all of the machinery is designed, gives a maximum aggregate output of 23,000 h. p.

The completion of Kaweah No. 5 plant, the reconstruction of Kaweah No. 1, and the enlargement of Kaweah No. 3, made possible by the Wolverton reservoir, will add 10,000 h.p., bringing the maximum aggregate output to 33,000 h. p.

Substations.

Substations of this company are placed either in towns or cities, or at the center of local distribution, where it has been determined that an economic point of voltage transformation should be obtained. The company maintains twelve substations, of which four are of the semi-outdoor type.

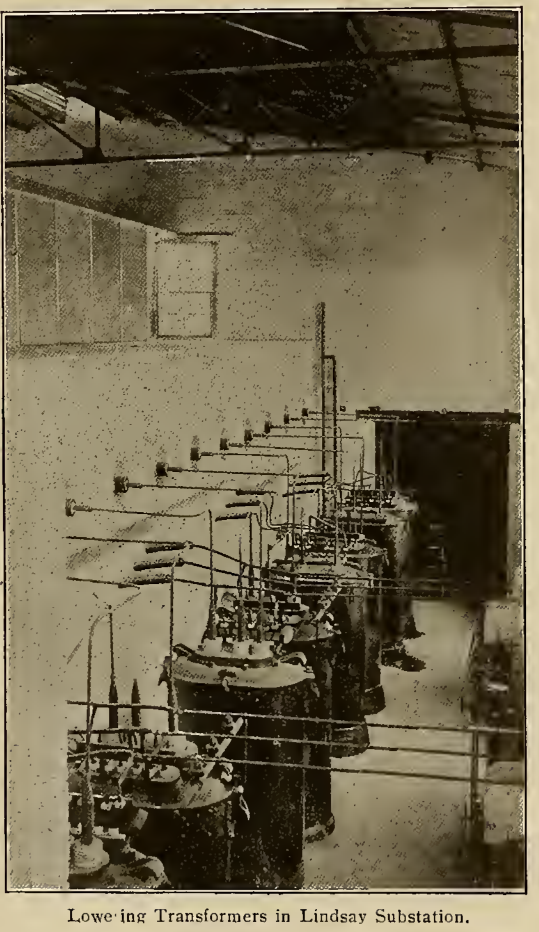
In Porterville, Visalia, Lindsay and Exeter, substations are in the central part of the towns. The newest and most complete of the substations is at Lindsay. Many of the substations in outlying districts are small corrugated iron buildings, and contain only the equipment necessary for a power service, and in many cases, do not require an attendant. The following list gives the type of building, transformer

capacity, voltage and number of circuits. A description of all the substations will not be entered into, but three of the principal types will be described.

Substations and Equipment.

Station.	Kind of Building.	Transformers. No.	K.v.a. Rating.	Capacity.	Secondary Voltage.	No. Secondary Circuits
Visalia	Brick	3	500	1500	2200	3
	Brick	3	350	1050	2200	1
Lindsay	Brick	4	500	2000	6600	5
	Brick	4	300	1200	2200	6
Porterville ..	Brick	2	500	1000	6600	4
	Brick	2	150	300	6600	1
	Brick	4	150	600	2200	3
Lemon Cove..	Cor. Iron	2	150	300	6600	2
Badger	Cor. Iron	2	75	150	2200	4
Venice Hill..	Cor. Iron	2	300	600	6600	1
Tulare	Cor. Iron	2	300	600	6600	3
	Cor. Iron	2	150	300	2200	4
Tipton	Cor. Iron	2	*300	600	6600	2
	Cor. Iron	2	300	600	6600	2
Delano	Cor. Iron	2	*500	1000	6600	5
Ducor	Cor. Iron	2	300	600	6600	4
Exeter	Cor. Iron	2	*300	600	2200	6
Success	Cor. Iron	2	*150	300	6600	2
Total: 12		44	....	13,300	....	58

*Outdoor Type Transformers.



Lowering Transformers in Lindsay Substation.

The Lindsay Substation is of brick, in two stories. The office of the company is in the front part, off the street, as one enters. The swtichboard for this station is mounted in the office space, so that it faces the street, and gives a businesslike appearance therefrom. The switchboard is black slate in 14 panels. The first panel contains a T. A. voltage regulator, rheostat control, and one generator switch controlling a synchronous converter. The second panel is devoted to high tension oil switch control and relays. The third is similar to the second. The fourth and fifth panels are blank for future transmission installations. The sixth and seventh have the switch control mechanism and meters for the 2200 volt city distribution. The remaining panels control outgoing 6600 volt circuits for a large district surrounding Lindsay.

On the main floor back of the switchboard is a large space, in which is a synchronous condenser similar to the one in use at Visalia. This has a 35 h.p. induction starting motor, and is connected to the condenser through a magnetic clutch. This is a very satisfactory device for starting the machine.

The exciter for the synchronous condenser is a two bearing Westinghouse 27½ h.p. induction motor, operating at 1125 r.p.m., and driving a d.c. 17½ kw. generator. An Edison storage battery operates the high tension switches, being charged by a small motor generator kodak set. This consists of a 5 kw., d.c. machine, driven at 1800 r.p.m., by a 2-phase General Electric induction motor.

The high tension transmission lines enter either side of the building. For the present, but one side is used, two lines entering here. Over the office space, and placed within two racks of concrete barriers, are the high tension 34,000 volt circuit breakers for the incoming lines. At present but two of these switch sets are in service. The two incoming lines connect to these switches through disconnectors, and between the oil switches and the bus line which feeds the transformers, are another set of disconnectors. The station bus line passes from the cross bus between the high tension switches to the rear of the building.

Interior View of Tipton Substation.

On either side of these are the high tension transformer switch cells. For the present the cells on one side only are equipped with switches, as but one-half of the transformer equipment has been installed. There are four sets of General Electric K-21 oil circuit breakers, which control the 34,000 volt lines, each

to a pair of General Electric lowering transformers. These transformers are wound for 30,000 volts on the high tension side, and are Scott-connected for 2300, or for 6600 volts, as the case may be, on the low tension side. Two sets of these transformers have a capacity of 300 kw., and the remaining two sets of 500 kw. each.

In the space devoted to the transformers are two 2-phase General Electric aluminum cell lightning arresters on the 6600 volt outgoing circuits, and also one General Electric constant current arc transformer, having a capacity of 14.6 kw., and with a current value of 6.6 amperes to supply a city street lighting service.

At Exeter and Delano, two new substations now approaching completion, are of a new type which has been adopted as standard. These stations have a two-story reinforced concrete building. On the first floor in front is the company's local office, and the switchboard controlling high tension and distributing lines. The high tension switching apparatus and bus lines are on the second floor. The high tension lines enter at one side, passing through oil circuit-breakers and disconnectors, to the main bus lines which run the length of the building, thence through a second set of circuit-breakers, passing through the opposite wall of the building to the out-door transformers. The transformers of which there are four at Delano and four at Exeter, are oil and air cooled, having capacities of 500 k.v.a, and are wound for 2200 volts secondary and are delta-connected. The secondary lines are carried back into the building to the low tension switches. A novel feature in the design of these stations is the use of the reinforced concrete roof trusses as barriers between the high tension bus conductors.

The Tipton Substation represents the semi-outdoor type. The station consists of a small corrugated iron building 30x15 ft., with a concrete floor. In this building is a 2 panel switchboard. Each panel has the remote control for two 6600 volt circuit breakers, together with the necessary instruments. Two K-21, 34,000 volt oil circuit breakers are equipped with mechanical remote control from a third marble panel. From this station there are four outgoing 6600 volt 2-phase circuits. The transformer equipment consists of a pair of air and oil-cooled corrugated case transformers, wound for 30,000 volt primary, to 6600 volts secondary, and Scott-connected for 2-phase operation. These have a capacity of 300 kw. The terminals are of the weather-proof type, and the transformers are placed on concrete bases in the station yard, about 50 ft. from the building.

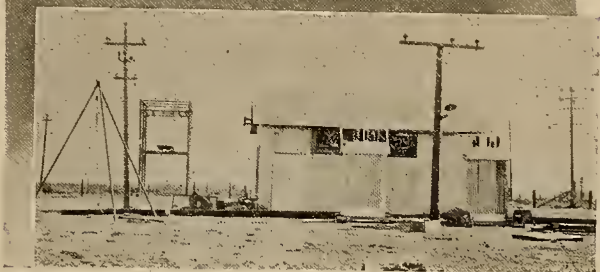
Two other similar transformers within the building are still in use. Since the original installation, the outdoor transformers having been added as the load upon the station increased. This substation is the junction of three transmission lines, being a sectionalizing point in the north and south lines and a junction point with the cross line to Porterville. All of the apparatus is of General Electric manufacture.

The remaining substations in the system are very similar to the last two which have been described, both in size of equipment, and in arrangement.

The demand for power during the coming year has been provided for by the ordering of additional transformers aggregating 10,000 k.v.a. in twenty units, which will be added to the various substations during the coming year. These are all of the outdoor type described for the Exeter and Delano substations.

Transmission and Distribution System.

The transmission system between the power houses and the substations as well as the various tie lines, is operated at approximately 34,000 volts, and is a 3-phase system throughout. The territory covered is extensive in point of area, but is condensed in point of service distribution. There are no extreme lengths of transmission, and, therefore, there is no object in employing extreme voltages on these lines. The average distance from the power stations to the center of distribution is about 35 miles.



(1) Substation at Tulare.
(2) Substation at Tipton, Showing Outdoor Transformers and Distributing Tower Structure.

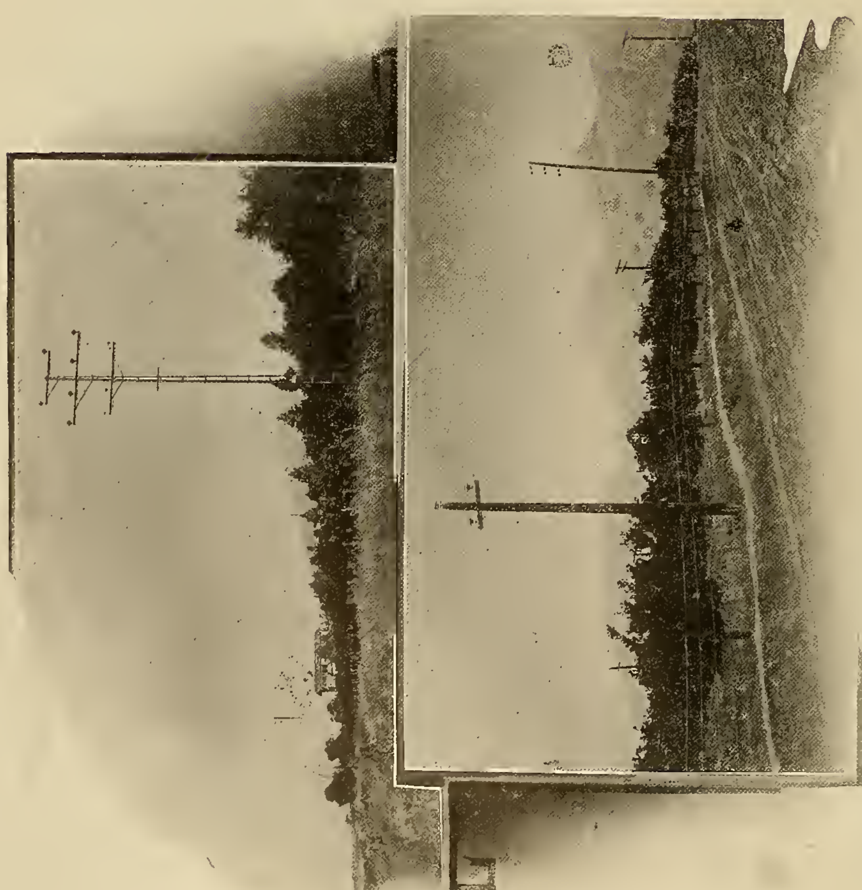
The transmission system consists of two main lines, the one from the group of power stations on the Kaweah River, while the other is from the Tule plant on the Tule River. The first line, which commences at Power House No. 3, is carried to Power House No. 1, thence to Power House No. 2, and from this point follows the Kaweah River in a general way, passing through Lemon Cove to a point about 4 miles north of Exeter. Here the line branches, one branch continuing to Visalia, the other to Exeter. These branches form the upper corner of a figure 8 in the transmission network which reaches all of the substations.

The line from the Tule power house follows the Tule River in a general way, passing through Springville and Success to Porterville, where it connects at the middle point of the eastern side of the forementioned figure 8. From Porterville a branch passes northward to Exeter, a second branch southward through Ducor to Delano, the most southerly point of the line, and a third, westward, forming the center line of the figure 8, to the substation at Tipton.

From the Visalia substation the west side of the figure 8 is formed by a line which passes southward through Tulare to the junction point at Tipton, and

The Visalia Steam Plant and Cooling Pond.

Lindsay Substation, Showing Tower Rack for Outgoing 6600-Volt Circuits.



(1) Two Circuit 35,000-Volt Line Near Porterville, on Tripartite Steel Poles.
(2) High Tension Wood Pole Line, Showing a Novel Corner Pole Construction.

(1) A Portion of the Merryman Ranch Orange Groves; the Main Pump House and Reservoir.
(2) The Home of an Orange Grower, Surrounded by His Orchard, Near Lemon Cove.

from this point continues southward to join the line from Porterville at Delano.

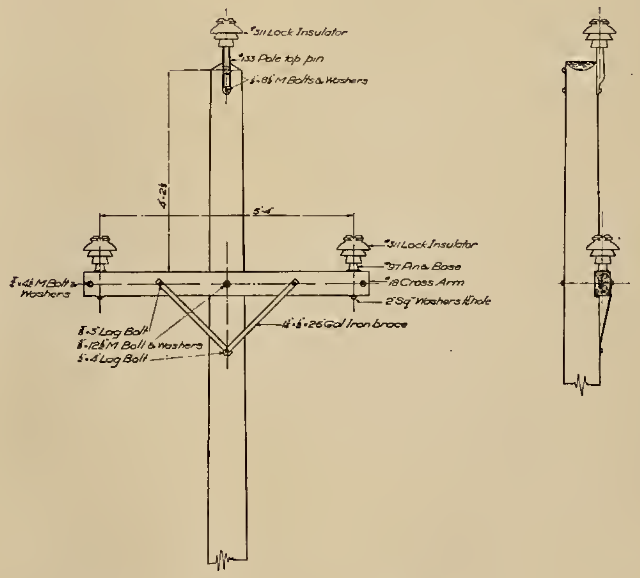
The main transmission lines and the above described high tension distribution have a total length of 182 miles. Much of the transmission follows county roads, the use of which is possible by franchises from Tulare and Kern counties. There are also many miles of line over private right-of-way, which has been purchased by the company.

A Junction on the 35,000-Volt Transmission; Tripartite Steel Poles.

The construction follows standard practice, and in nearly all cases the transmission lines have a single circuit, in which there is one crossarm carrying two of the conductors, while the third is mounted on a pin at top of the pole. There are a few places where double construction is used, in which case there are two arms, the circuits forming triangles on either side of the pole.

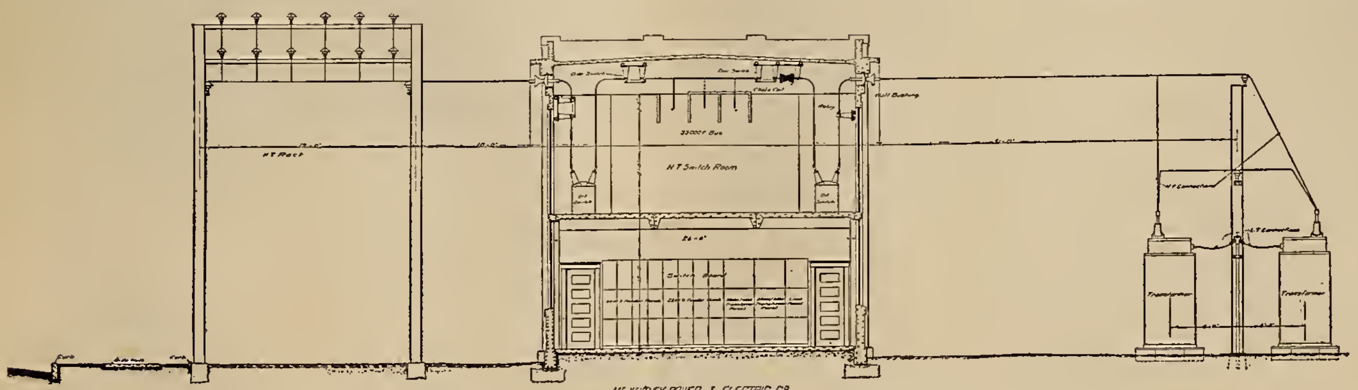
The main line from the Kaweah plants consists largely of 30 and 35 ft. sawn butt-redwood poles. This line was built at the time that the No. 1 Plant was built, fifteen years ago, and it is said to be in a remarkably good state of preservation. The line from the Tule power house to Porterville is constructed of round Washington cedar poles, 35 and 40 ft. long. The remainder of the transmission is largely of the same type of construction.

There is a unique feature in making sharp turns in the single circuit lines, these turns being necessary where the line follows county roads, and where the roads follow section lines. This consists of a pole on which there are three suspension type deadend insulators, placed one above the other, and fastened directly to the pole without the use of a crossarm. The pole is guyed back to equalize the strain of the transmission wires.



Standard Wood Pole Top.

At one point in the transmission between Porterville and Lindsay there has been adopted the Tripartite type of steel pole. These poles carry both single and double circuits. The Tripartite pole is made of three steel "U's" which are held together by structural sections, fastened by rivets. The crossarms are angle sections, carrying insulators with steel pins. These poles are 40 ft. long, and weigh 1100 lb. each. They make an exceedingly durable construction for



Cross Section of New Standard Reinforced Concrete Substations at Exeter and Delano.

a transmission line where the weight of conductors is not excessive, and also make a pleasing appearance.

The transmission lines are sectionalized at the various substations through pole-top switches, and also at some points through oil circuit breakers. The system of transmission is such that in case of trouble at any point, the section where the trouble occurs can be cut out, and power can be fed around in another direction. This is possible by the figure 8 high tension network which is fed into at three points.

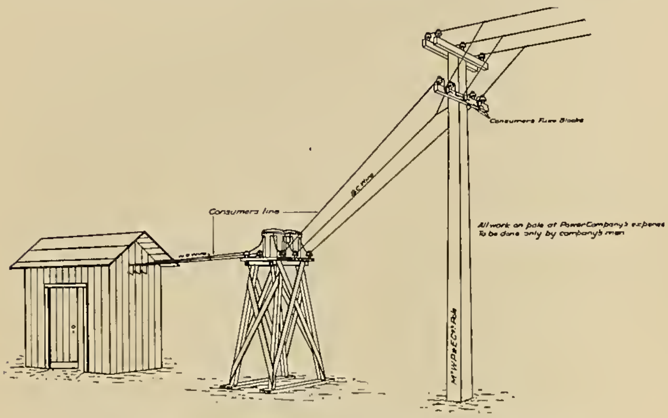


Diagram of Standard Method of Mounting Transformers, and Making Connections to Pumping Plants.

A new steel tower transmission line from the Kaweah power plants to Lindsay, substation a distance of 33 miles, to provide for the increased output of No. 3 power house and for the No. 5 plant when completed, will be built during the coming year. This is clearly shown on the general map of this system. From Lindsay this new line will be continued to Tulare and will form a new feeder for the west side of the network. This line will be designed for 66,000 volts operation.

Distribution Lines.

There are two types of distribution lines used. The one which covers the greater part of the distribution system operates at 6600 volts. The other, which is for service within towns and cities, is for 2200 volts.

The 6600 volt distribution lines are very extensive, and cover practically every part of the territory which is served by this system. The poles are round Washington cedar 30 and 35 ft. long, and carry a single crossarm with three insulators. The entire 6600 volt service is 2-phase, and is distributed on three conductors, the center conductor being a common wire between the phases. Wherever distribution lines from different substations, in their meanderings approach each other, they are tied together, so that a large part of the distribution system forms closed networks. By this means it is possible to sectionalize these networks, so that if there is trouble at any point the remainder of the networks may be supplied from another substation.

The 2200 volt lines, where they are carried outside of towns for power service, have a similar pole construction, and like the 6600 volt lines, are all 2-phase. The local distribution in all of the towns, is 2200 volts, 2-phase, with the exception of the city of Visalia. Here the local distribution is 3-phase. Sectionalizing pole switches are used throughout the 6600 volt networks for the control of these lines. These switches are hand operated, and are of the double break swivel type, manufactured by the K. P. F. Electric Company of San Francisco. There is an aggregate of 1080 miles of 6600 and 2200 volt, 2-phase distribution lines.

A noticeable departure from current practice has been maintained in the mounting of power distribution transformers. It has been noted that the principal power business is pumping water for irrigation of orchards and farms. There are something over thirteen hundred pumping units which are served by the distributing lines of this system. Each one of these units consists of a small building, in which are placed either a centrifugal, or a deep well plunger pump, driven by an induction motor. These plants vary widely in their appearance and design, some of them being elaborate and artistically finished, others being nothing more than a protection for the enclosed machinery. Those plants which are near the foothills where water is at some distance from the surface. have deep well pumps. The plants located further out in the valley and toward the western part of the area covered by the system, where water is nearer the surface, are equipped with centrifugal pumps, but in all cases 2-phase induction motors of from one to

The Substation at Porterville. In the Rear Is the City Water Works.

75 h.p. are used. The transformer equipment consists invariably of two transformers of size suitable for the motor installation. These are mounted on a platform which is generally about 10 ft. above the

ground, and is supported on a timber structure properly braced. The object in using this type of transformer mounting instead of hanging the transformers over a crossarm on the pole, has been two-fold. It removes the danger of contact with high tension wires, which are brought from the pole directly to the tops of the transformers, and in the event of trouble to the transformer, the entire installation is away

Water Works and 100,000 Gallon Tank at Exeter.

from charged wires upon removing fuses. The fuse blocks, which protect the transformers, are mounted on a crossarm in the usual manner on the nearest pole. The second reason for this mounting is to facilitate the care and examination of the transformers and make it possible for others beside the company's employes to erect the transformer structure and place the transformers in position, the cost of this method being no greater than if the transformers were mounted on the pole.

Aside from pumping water for irrigation, the company supplies power for all the towns and cities which are reached by its lines. In the city of Tulare the water supply is owned and operated by the municipality, which also owns the power equipment for pumping. This consists of one Krogh 2-stage 6 in., and one 1-stage, 8-in. centrifugal pump, driven by a 50 h.p. induction motor. This plant pumps water into a 150,000 gal. tank, whose elevation above the ground is 132 ft. At Exeter a similar municipal system is operated by the company, there being here two 20 h.p. induction motors, which drive two, 2-stage 5 in., centrifugal pumps. Here also is an elevated tank, having a capacity of 100,000 gal.

At Porterville a 50 h.p. induction motor drives a 2-stage centrifugal pump, which supplies a 75,000 gal. tank, while in another part of the city a 30 h.p. motor drives a vertical centrifugal pump, supplying water to a 300,000 gal. tank, which is placed on a hill back of the city.

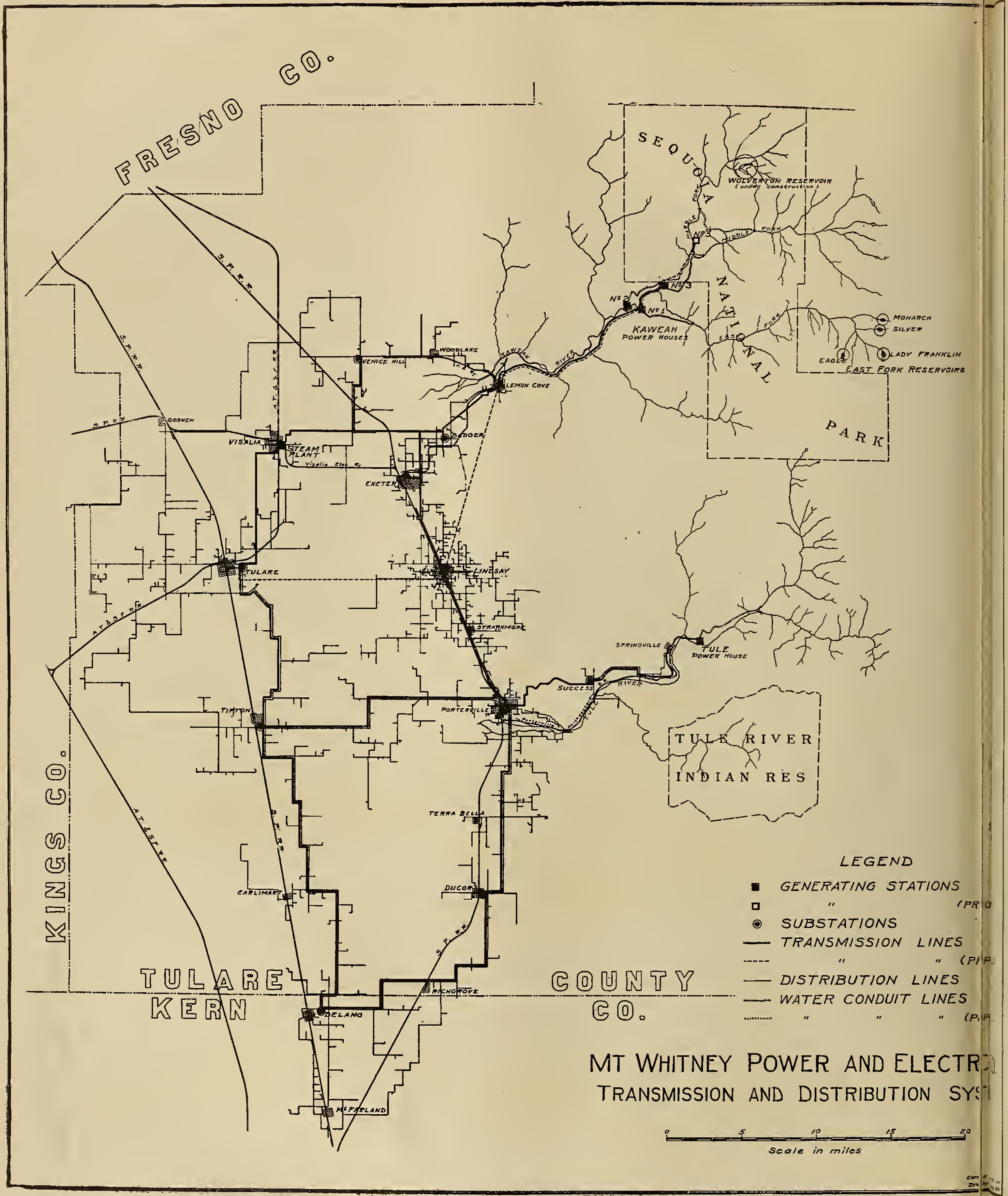
At Lindsay and Strathmore there are also high tanks which receive their water supply from wells, the water being pumped by motor driven pumps.

Some of the ranch irrigation equipments are very extensive. This is notably the case with the Merryman ranch, one of the most extensive citrus ranches in the state. Here the orchards extend far up a hillside, and cover many hundreds of acres of ground. It is necessary to pump water to an elevation of 440 ft. For this plunger pumps are used. The main installation is equipped with one 75 h.p. and one 30 h.p. induction motor. Water is pumped into a large reservoir, having a capacity of one million gallons, and from here it is pumped as required into the irrigation system. On this ranch alone there are twenty-two wells and pumping stations, each with its motor and transformer equipment.

From the commencement of operations a rate for power of $50 per year per horsepower was established. This rate has been consistently maintained. While it is possible at this rate to use the power day and night throughout the year, pumping plants seldom use power steadily for more than eight months a year. This average use brings the rate for pumping to 1.16 cents per kw.-hr. which is equivalent to 0.87 cents per horsepower hour. While not pumping it is allowable to use the power for lighting which gives in the aggregate a very low rate to the customer and at the same time assures the company a fair return on its investments. This rate applies as well to a 1 h.p. motor as to a larger size and hence the cultivation of small tracts of land is encouraged.

Street lighting systems are maintained in all of the principal places. In Visalia and Porterville these systems are 6.6 ampere direct current series services, and magnetite arcs and large tungsten series lamps are used. In Visalia a new system of this sort has been recently installed.

The territory served by this company extends from the northern part of Tulare, across that county and into Kern, in a north and south direction for 60 miles, and from its power plants on the Kaweah and Tule rivers in the mountains, westward to the western boundary of Tulare county near the center line of the San Joaquin valley a distance of 40 miles. The area covered is about 1,000,000 acres and the system of distribution has grown year by year from a few scattering districts until now it reaches practically every square mile within its bounds. Of this territory about 60,000 acres or about 8½ per cent of the tillable land is now under cultivation, made possible by the water pumped by power supplied by the company. The remaining land within present reach of the company's lines is available for similar cultivation, as the population and its wealth shall increase, together with the constant setting out of new orchards, the subdivision of lands into new farms and the steady growth of the power load is evidence of the steady and healthful growth. It is also evident that the opportunity for growth within the territory covered is enormous.


FRESNO CO.
KINGS CO.
TULARE COUNTY
KERN CO.
SEQUOIA NATIONAL PARK
WOLVERTON RESERVOIR (under construction)
MARBLE FORK
MIDDLE FORK
EAST FORK
Nº 3
Nº 2
Nº 1
KAWEAH POWER HOUSES
KAWEAH RIVER
MONARCH
SILVER
EAGLE
LADY FRANKLIN
EAST FORK RESERVOIRS
WOODLAKE
VENICE HILL
LEMON COVE
GOSHEN
VISALIA
STEAM PLANT
Visalia Elec. Ry.
BADGER
EXETER
LINDSAY
TULARE
STRATHMORE
SPRINGVILLE
TULE POWER HOUSE
SUCCESS
TULE RIVER
PORTERVILLE
TIPTON
TULE RIVER INDIAN RES
TERRA BELLA
DUCOR
EARLIMART
RICHGROVE
DELANO
McFARLAND
S.P.R.R.
A.T.&S.F.R.R.
LEGEND
GENERATING STATIONS
SUBSTATIONS
TRANSMISSION LINES
DISTRIBUTION LINES
WATER CONDUIT LINES
MT WHITNEY POWER AND ELECTR
TRANSMISSION AND DISTRIBUTION SYS
0 5 10 15 20
Scale in miles

While the pumping load absorbs 70 per cent of the annual kilowatt-hour output from the plants, there is a steadily growing industrial power load, in every use which may be found in cities and outlying communities. Notable among the diversified power supplies, is that for operation of the Visalia Electric Railway system. This is an interurban line which extends from Visalia, the county seat, and the largest city in Tulare county eastward through Exeter and then winding through the orange orchards among the foothills, having its terminus at Lemon Cove, a total distance of 35 miles. Numerous branches make possible an outlet for the extensive shipments of the citrus fruits, whose cultivation on a large scale is made possible from the supply of power by this company. This railroad, which is a feeder to the Southern Pacific, receives power at its transforming substation in Exeter and distributes this power along its lines, through its own substations, for the operation of its trains.

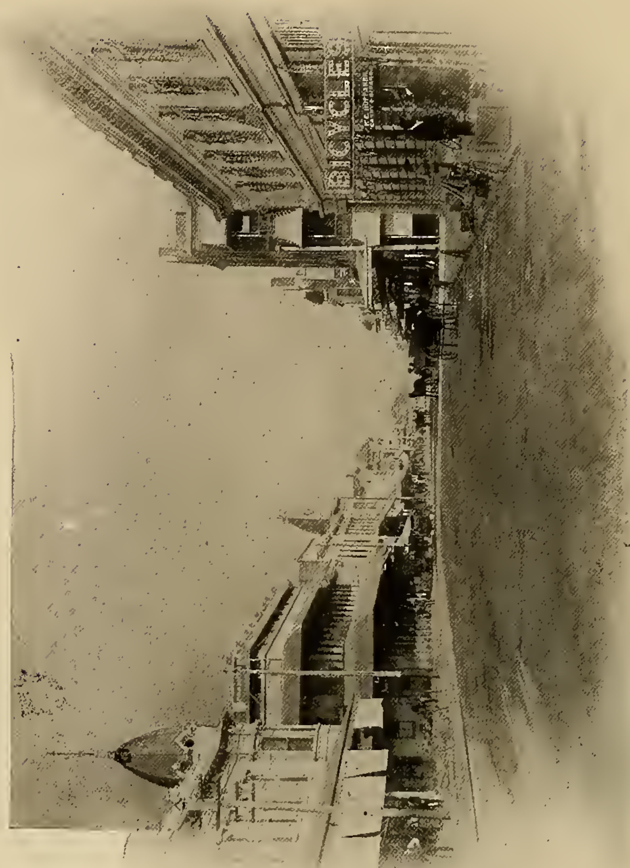
The third branch of the power business of this company, which is at the present time undergoing a phenomenal growth, is the supply of electricity for lighting and heating. The former is common to all electrical systems in populous communities, but the supply of power for heating and cooking has, as a rule, scarcely passed the novelty stage. An especial effort has been put forth to develop this feature of the business by giving a sliding scale of rates for domestic service. A monthly minimum takes care of the average lighting load and the rate then automatically lowers to a point where heating and cooking cost will come within the limits usually allowed for these expenses in the household. These rates range downward from 10½ cents to 1 cent per kilowatt-hour and a further discount of 15 per cent is allowed for the prompt payment of bills. Scores of testimonials have been received from customers who have been pleased with this arrangement,

The diversity factor of this system is such that it is not only possible but quite advisable to encourage this business on a large scale. In this respect this system differs from many other transmission systems and it is due, not only to the fact that the major portion of the load is a pumping load for irrigation, but from the additional fact that it is largely irrigation for the cultivation of citrus fruits and that the period both in respect to the time of year and also to the time of day, when there is a sag in the power pumping curve covers the time of maximum demand for domestic uses. This situation of load is a further assistance in the matter of storing water in the high mountains to uphold low water flow for the power plants and makes a much smaller storage requirement than might be necessary if the load were of a different nature.

Typical Irrigation Pumping Plants.

(1) Pump House of El Cerritos Rancho, Near Lindsay. (2) Pump House and Tank on St. Johns River Colony.
(3) Typical Deep Well Pump Near Lindsay. (4) A New Pump Installation in the Center of a Young Orchard.

Street Scene in Lindsay.



Street Scene in Visalia.

An Orange Orchard Near Lindsay.

Commercial Section of Porterville.

The advent of electricity for pumping has virtually displaced the steam or gasoline engine for this purpose and the systems in use for putting water on the land are diversified and in many cases extensive.

While the greatest horticultural development has been along the lines of citrus fruit culture, the irrigated areas are by no means devoted entirely to this industry. Large tracts of vineyard are under cultivation and alfalfa, maize and sugar beets are among the other products. Near Visalia there is a beet sugar factory supported by the beet production of the locality, this is operated by electricity furnished by the company.

An Olive Orchard Near Lindsay.

A new horticultural industry has been established, being made possible through the power supply of this company. This is the raising of Turkish tobacco. That this promises to be a very important addition to the rapidly growing resources of this territory is evinced by the fact of the rapid growth in the production. During the last year over 200,000 lb. of tobacco was raised and sold, an average price of 50c per lb. being obtained by the grower.

The raising of the finest naval oranges, lemons and grape-fruit represents perhaps the highest use of the land.

In Tulare county and within the reach of the lines of the company there is now planted an aggregate of 40,000 acres in naval oranges alone, over 6000 acres having been planted during the last year. This does not include the acreage devoted to the other citrus fruits, but forms about one-fifth of the entire acreage planted to citrus fruits within the state of California. The shipments of these fruits for the past year from this district amounted to 5000 carloads. What is known as the citrus belt is somewhat limited to the lower foothills and the valley land which adjoins the foothills or extends between isolated knolls. And while one may travel along the county roads hour after hour between solid rows of orange trees, he may see, extending far up the hillsides and as far as the eye can reach, the regular lines of the rich sombre colored foliage characteristic of all citrus trees. There are many little valleys nestling far into the higher foothills and even approaching the mountain canyons and these are dotted with orchards and will eventually be thoroughly filled with the intensively cultivated trees. Almost everywhere one may look, he may count on seeing a small pumping plant building, often very tastefully finished and decorated to blend with the color and regularity of the surrounding trees, containing the pump and motor, and outside the supply transformers and the poles and lines of the company.

Views of the Company's Office, Visalia.

The population served will aggregate 60,000, and while much of this number is scattered among the ranches, there are prosperous cities and towns which give every evidence of the wonderful productiveness and wealth which has been an essential part of the development of the county. These cities as well as the outlying section are well supplied with the company's service for all purposes and in each place there is maintained an office and the force necessary for the surrounding district.

Twenty years ago most of the land served by the company's lines might have been purchased from $10 to $15 per acre. Today raw land is held at from $250 to $400 per acre, due to the availability of cheap power for pumping. This company has helped to add to the assessed valuation of Tulare County over $25,000,000.

The principal place of business is Visalia which is the county seat of Tulare county. This is a city of 6000 inhabitants and while there is a well arranged and extensive commercial section, it is essentially a city of homes. Here are the main offices of the company.

These are housed in a commodious two-story brick building. As one enters, a large space is pre-


John Hays Hammond
Founder
John Hays Hammond Jr.
President & Gen. Manager
E. E. Baker
Secretary
Ben M. Maddox
Vice Pres. & Bus. Manager

sented devoted to the local business of the company, where there is also on exhibition various electrical appliances for heating and cooking. In the rear are the offices of the various business departments. On the second floor are the offices of the president and the business manager which are well appointed and in keeping with the importance and magnitude of the business over which they have control. The remainder of this floor is given over to the offices of engineers and a large drafting room. Even with these commodious quarters, the business of the company is increasing so rapidly that the space available has become already overcrowded and it is proposed to add a third floor in the near future. From this point the power load for the system is handled, a load despatcher being at all times in touch with every part of the system by means of the company's own telephone system.

The second city in importance is Porterville. This city of 4000 people, is 32 miles southeast of Visalia and is beautifully situated at the base of the foothills in the midst of the citrus belt. This city makes an exceedingly favorable impression upon the visitor by its fine streets and many handsome buildings. The local distributing system originally owned by the Porterville Light & Power Company, was purchased by the company in 1900.

The city of Tulare is 10 miles south of Visalia on the main line of the Southern Pacific and a branch line of the Atchison, Topeka & Santa Fe Railway. It has a population of 3000 and is similar in many of its characteristics to the county seat. It is surrounded by a rich farming country. The company's office here is in the center of the commercial district while the substation is about a mile east of the city.

Exeter and Lindsay are well laid out and rapidly growing towns of about 2000 inhabitants each, both possessing many beautiful homes and fine public buildings. They are located southeast of Visalia and between that city and Porterville and are in the midst of orange groves. They are important fruit shipping points and contain extensive packing houses and cooling stations. Lemon Cove and Springville are well back into the foothills and are also important fruit shipping points. The remaining places where local service is maintained are the centers of rapidly growing agricultural districts and have substations from which service to the district which surrounds them is delivered.

It is due to the courtesy and assistance of Mr. John Coffee Hays, president, Mr. Ben M. Maddox, business manager, and Mr. H. A. Kluegel, chief engineer of the Mt. Whitney Power & Electric Company, that it has been possible for the writer to obtain the detailed information for this description and the facilities for taking the great number of photographs by which it has been illustrated.

Mineral Production in Utah places that state second in silver, third in lead, fourth in copper, sixth in gold and seventh in lead. Utah holds a unique position among the metal-producing states in the diversity of its mineral output. The total output of this state for 1912 was $51,004,942, which is an increase over 1911 of $7,230,611.

"PARTNERSHIPS" VS. "PRINCIPAL AND AGENT" IN PUBLIC UTILITY RATE MAKING.

BY J. F. DIX.

(This article is submitted by the author as a comment upon the theory of Principal and Agent as the fundamental relationship existing between the public and its public utilities, and in presenting his views upon this subject the author advocates as a more equitable basis of rate making a consideration of that relationship instead as a Partnership, and gives much interesting matter in support of this different view.—The Editors.)

Commissioner Max Thelen of the Railroad Commission of the state of California, in the issue of the Journal of Electricity, Power and Gas of November 22, 1913; under the title of "A New Rate Making Basis" has developed the idea that "the fundamental relationship existing between the public and its public utilities is that of principal and agent." The commissioner has undoubtedly attempted to place the question of rate making upon a sound basis by a return to first principles, and the exposition of his theory is worthy of serious consideration. In view of the recent trend in matters of this kind, wherein hypothetical reasoning and mathematical gymnastics seem to have taken the place of logical thought, a return to fundamentals is indeed healthy. At first glance the "principal and agent" argument is extremely plausible but further thought leads one to believe that there is certainly a better and far more equitable basis for rate making than this idea permits.

In agency, an agent is entitled to be reimbursed for the money which he expends for the benefit and account of the principal together with proper remuneration for his services. It is also true that any profits which may accrue from the actions of the agent on behalf of his principal should be solely for the benefit of the principal. This idea may be applied to public service corporations in a certain moral sense; but is it a sound basis for rate making? Is the agent comparable to the utility, when one considers that the agent in the usual acceptance of the word carries no investment, other than a relatively small working capital, while on the other hand, the public utility makes the entire money sacrifice? To illustrate the point recourse may be had to a very common realty transaction. A wishes to appoint B his agent, and states to B: "I own a tract of land which I wish to develop and sell; reposing trust in your ability and honesty I will appoint you my agent, setting aside a sum of money at your disposal to be used in the development of the property. For this effort on your part, I will compensate you with a certain sum each year." In this example B, the agent, will make no investment, will assume no risk and assuredly will not expect to derive any profit from the sale of the land but will look to the salary paid him to act as agent for his remuneration.

Is it just or equitable to treat a public utility organized and built up by private initiative courage and capital, merely as an agent? This would be parallel to A saying to B: "I own a tract of swamp land of little value. If you, at your own expense will drain the land construct streets and otherwise develop the property and if the land is sold at a large profit, I will return to you your investment, plus a certain compensation for your services." B under such conditions, would hardly be eager to act as agent for A, and yet

such a case is exactly analogous to the conditions proposed to impose upon public service corporations. Few indeed would be the utilities initiated by private capital, if it were known in advance that the "principal and agent" measure were to be applied after the pioneering and development stage, and as a reward for courage. If the public is to consider itself the principal, and at this late day is to look upon public utility corporations in the light of agents and is to ask its so-called agents not only to provide adequate service, but in addition is to ask that its agents invest their own money, then the day of private ownership is at an end and government ownership is in the near future.

An analysis of the conditions just preceding the organization of a public utility should give the basis for the relationship between the public and its public utilities. The conditions precedent to any contract are the basis of agreement during the life of the contract, whether the relationship be that of master and servant, principal and agent, or any other. In the early days of electric light service, when little was known of the art as it is developed today and only the most far-sighted could see its future prospects; few, if any municipalities did build or were willing to build plants, choosing rather to expend their efforts and money to make extensions in the better known fields of road building and water works. Here and there groups of men went before the public or their representatives willing to invest their money in a hazardous undertaking, to supply an improved form of lighting, merely asking, that in return they be allowed to use the public streets in order that service might be supplied. In this tremendous industry as it exists today, the public, in the meaning of the word as used in this article, has not invested a cent, has risked nothing, has made comparatively no effort and yet it is proposed that it shall now usurp the place of principal and assign to corporations, who have done these very things, the inferior position of agent, as a reward for success. Would it not be more just and more equitable to term the relationship between the public and its public utilities as "partnership" rather than "principal and agent."

Partnership is the result of a contract whereby two or more persons agree to combine for the purpose of a common undertaking and the acquisition of a common profit. This relationship may be illustrated by reference to the second example above outlined, except in this instance. A would say to B: "I own a tract of swamp land of little value, but of such location that, if properly developed, should yield large profits. If you, at your own expense will drain the land, construct streets and otherwise develop the property, we will form a partnership and the profits secured from the sale of the land, will be shared between us. I have little faith in the project, and I have other uses for my money, but if you believe it can be done and will invest your money, we will share the profits."

This is analogous to the case of the public utility for the public had little knowledge of the service to be rendered or its possibilities and offered as its contribution to the partnership, the use of its streets. In order that the work might not be unduly hindered, the public in addition granted to those who were to contribute their money and time, the power of eminent domain. The profit to be derived from such a combination will be service to the public and a return on the money invested to the promoters of the utility. And if, in this partnership the public may on the one hand receive increased profits from improved service as the industry is perfected, may not the public service corporation, on the other hand realize added profits on the increase of their money investment? If we accept the "principal and agent" theory; appreciation of values can not be allowed in rate making or we would violate the fundamentals of that relationship, but if we apply the rules of partnership, one partner can not enjoy the profits to the exclusion of the other. That the corporation is entitled to earn on what ever increase in value has taken place in its property would seem to be confirmed in Wilcox vs. Consolidated Gas Company, 212 U. S. 52 (1909) wherein the Supreme Court states: "and we concur with the court below in holding that the value of the property is to be determined as of the time when the inquiry is made regarding the rates. If the property, which legally enters into the consideration of the question of rates, has increased in value since it was acquired, the company is entitled to the benefit of such increase." If in rate making under the "principal and agent" idea it is impossible to allow a return upon the increased value of real estate or other property, then the highest court in the land does not endorse the plan, if we are to accept as final the above citation.

No attempt is made to claim that the "partnership" plan as noted herein of itself would be acceptable or that any other single basis can be acceptable; but if choice must be made between the two thoughts, and if, all things considered, justice and fair dealing to both sides are the ends sought in any rate investigation, success will not lie in the "principal and agent" basis. In fact, any attempt to deduce the value of a public utility upon which to base a rate, through a mathematical formula or other means to a single basis must be unsuccessful. In a subject of such magnitude, the greater the number of angles of approach, the more diverse the points of view, the more care with which the various factors are weighed, the greater the measure of success and the greater the possibility that the final result will do justice, both to the public and to its partners, who carry the investment and shoulder the annoyances and risks in supplying the necessities and conveniences commonly included under the head of public utilities. This has been clearly stated by Mr. Justice Harlan in Smyth vs. Ames 169 U. S. 546 (1898): "We hold, however, that the basis of all calculations as to the reasonableness of rates to be charged by a corporation * * * must be the fair value of the property being used by it for the convenience of the public, and in order to ascertain that value, the original cost of construction, the amount expended in permanent improvements, the amount and market value of its bonds and stock, the present as compared with the original cost of construction, the probable earning capacity of the property under the particular rates prescribed by statute, and the sum required to meet operating expenes, are

all matters for consideration and are to be given such weight as may be just and right in each case. We do not say that there may not be other matters to be regarded in estimating the value of the property. What the company is entitled to ask is a fair return upon the value of that which it employs for the public convenience. On the other hand, what the public is entitled to demand is that no more may be exacted from it for the use of a public highway than the services rendered by it are reasonably worth."

Therefore, if we are to determine the true value, we must consider:

1. The worth of the service to the public.
2. The capitalized value of the undertaking.
3. The market value of the stocks and bonds.
4. The reproduction cost or the cost new of the property.
5. The present value of the property, and
6. The original cost.

And having all these, they should in the words of Mr. Justice Harlan "be given consideration, and allowed that weight to which it is entitled. It is, after all, very much a question of sound and well instructed judgment." If we are to attempt to base a rate on but one of these, or are to consider values solely on such an assumed relationship as outlined under the "principal and agent" idea, then we remove the incentive for improvement by removing the reward for improvement; discourage investment in utility securities by reducing the return for such investment, and the public will be deprived of service or the improvement of service, that is its share in the common profits of the partnership with the public service corporations.

The Nitrogen-filled Electric Lamp will be one of the most interesting of the numerous engineering novelties that will be included in the equipment of the Panama-Pacific International Exposition in 1915. This lamp was developed by Dr. Irving Langmuir, of the research laboratory of the General Electric Company at Schenectady, N. Y. It will be used for the first time in general, useful practice, in the standard lighting in all the small courts of the exposition, and throughout the Court of the Sun and Stars, including the fountains in that great central court. The lamps will vary in candle-power between 1,525 and 2,500, and there may be a few as high as 5,000 candle-power. For years, efforts have been made to produce lamps of greater efficiency than the ordinary tungsten lamps. For a long time, it was found impracticable to improve the lamps much more than 10 to 20 per cent corresponding to an increased efficiency of only a few hundredths of a watt per candle-power. The melting point of the filament of a tungsten lamp although high, prevented any increase in efficiency more than 0.2 of a watt per candle-power. Beyond that figure the bulb blackened early and so reduced the candle-power and efficiency of the lamp. After long investigation and experiment, it was found that the only gas that caused blackening of the lamp bulb was water vapor. With this discovery came plans for eliminating this vapor, and the introduction of nitrogen vapor at atmospheric pressure into the lamp bulb was found to solve the problem.

PUBLIC UTILITY ACCOUNTING IN OREGON.

Instructions Pertaining to Uniform System of Accounts for Electric, Gas and Water Utilities.

(Concluded.)

14. **Plant and Equipment and Other Property Purchased.**—When any property in the form of a going or completed plant is purchased, an appraisal of the property so acquired should be made, and the different constituent elements of the plant (and equipment, if any) or other property acquired should be appraised at their structural value; that is to say, at the estimated cost of replacement or reproduction less deterioration to the then existing conditions through wear and tear, obsolescence, and inadequacy. If the actual money value of the consideration given for the plant or other property was at the time of the acquisition in excess of such appraised value, the excess should be charged to account "Other Intangible Capital," and the appraised value of the constituent elements should be charged to the appropriate fixed capital accounts as hereinafter designated. If the actual money value of the consideration given was not in excess of such appraised value, such actual money value should be distributed through the said accounts in proportion to the said appraised value of the constituent elements appropriate to the respective accounts.

Utilities should be prepared to furnish the commission upon demand, a full report of the contract of acquisition, the consideration given therefor, the determination of the actual money value of such consideration if other than money, the appraisal, and the amounts charged to the respective accounts for each plant or other such item of fixed capital purchased. The purchaser is required to procure in connection with the acquisition of any such plant or other item of fixed capital all existing records, memoranda, and accounts in the possession or control of the grantor relating to the construction and improvement of such plant and to preserve such records, memoranda, and accounts until authorized by law to destroy or otherwise dispose of them.

15. **Fixed Capital Withdrawn or Retired.**—When any tangible fixed capital acquired prior to July 1, 1913, is withdrawn or retired from service for any cause, the amount at which it stands charged should be credited to the sub-account under account "Fixed Capital Installed Prior to July 1, 1913," in which it is charged, and such amount plus the expenses incident to the retirement, less the value of salvage, should be charged to account "Reserve for Accrued Depreciation," for the proportion applicable to the period covered by the reserve, and to account "Realized Depreciation not Covered by Reserves" for the remainder. Such portion only of the realized depreciation shall be charged to account "Reserve for Accrued Depreciation," as is due to life in service during the period for which the reserve was established; this portion may be estimated on the basis of the proportion which the life in service of the property in question after that date bears to its entire life in service.

The entry of the credit to the fixed capital account should cite by name and page of book or other record the original entry of cost of the thing withdrawn. If there is no such original entry, that fact should be stated in connection with the credit entry, and the actual amount originally charged should be

credited. If such amount is not known, it should be estimated, the facts upon which the estimate is based and the name of the person by whom estimated should be shown, and the amount thus estimated to be equivalent to the original charge in respect of such thing withdrawn should be credited to the fixed capital account involved.

When any tangible capital acquired subsequent to June 30, 1913, is withdrawn or retired from service for any cause the amount at which it stands charged should be credited to the fixed capital account in which it is charged, and such amount, plus the expense incident to the retirement, less the value of salvage, should be charged to account "Reserve for Accrued Depreciation."

The entry of the credit to the fixed capital account should cite by name and page of book or other record the original entry of cost of the thing withdrawn.

If the age of tangible capital withdrawn or retired from service cannot be determined for classification between account "Fixed Capital Installed Prior to July 1, 1913," and account "Fixed Capital Installed Since June 30, 1913," the property so retired should be treated as having been charged to the former account, and the necessary credits should be made to the subaccounts thereunder.

When any fixed capital is withdrawn or retired whose book value as carried in the fixed capital account has been reduced by writing off estimated depreciation, only that part of the realized depreciation which has not already been written off should be charged to account "Reserve for Accrued Depreciation," or to account "Realized Depreciation Not Covered by Reserves."

When any fixed capital is withdrawn or retired whose book values is greater than the known or estimated cost such excess should be charged to account "Other Deductions from Surplus," and the realized depreciation should be charged as elsewhere directed.

If any fixed capital is sold for more than its original cost, the amount of depreciation, if any, accrued and credited to a reserve in respect thereof, should be determined as accurately as possible and charged to such reserve. The sum of the amount so charged and the excess of the selling price over the cost of the property should be credited to account "Miscellaneous Additions to Surplus."

16. **Operating Revenues Defined.**—By "operating revenues" are meant all amounts of money which the utility receives or becomes lawfully entitled to recover for services rendered and as the return upon property used by the utility in its own operations. Credits to the various revenue accounts should be based upon the gross charges made for services rendered by the utility. Discounts allowed for prompt payment, correction of overcharges, over collections theretofore credited and afterwards corrected, authorized refunds on account of failure in service, should be charged to the "Primary Revenue" account to which they relate.

Commissions paid to employes or others in lieu of salaries should be charged to the appropriate "Expense" accounts, and not to "Revenue" accounts.

17. **Operating Expenses Defined.**—By "operating expenses" are meant those out-goes (including capital consumed) necessary to the maintenance of the organization of the utility, production of the commodity sold and the services rendered and to the collection of revenue.

Except where some other meaning is clearly specified in the definition of the operating expense accounts the following words wherever used have the meaning as stated below:

"Cost, means cash or money cost and not price based on term of credit."

"Labor means human services of whatever character."

"Cost of Labor includes wages, salaries and fees paid to persons for their services."

18. **Repairs Defined.**—Repairs as herein used consist of ordinary and extraordinary repairs. Ordinary repairs include replacements of minor or short lived parts of structures, equipment, or facilities; replacement of minor parts of structures or equipment, made necessary by reason of faulty construction, excessive strains, mechanical injuries, or other minor casualties not provided against in charge for depreciation of plant and equipment; rearrangements and changes in location of equipment (except consumers service equipment), etc. Ordinary repairs are not required to be taken into account in fixing a rate of depreciation. Extraordinary Repairs include restoring to an efficient or proper condition, buildings, structures, or other units of property which have deteriorated; substituting, in order to maintain normal efficiency, new parts for old parts of continuous structure, such as pole line, cables, wires, conduits, pipe lines, etc., where such substitutions do not amount to a practical replacement of any considerable length of such continuous structures; restoring the condition of property damaged by storms, floods, fire, or other casualties; recovering salvage and removing retired or abandoned property in connection with the above kinds of work.

Extraordinary repairs should be provided for by adequate charges to depreciation. When it is necessary substantially to reconstruct or to replace a major portion of any unit of property or any important section of a continuous structure, the cost should be handled through the Capital account; that is, the cost of property removed or replaced should be credited to the appropriate Fixed Capital accounts, and the new property should be charged thereto.

All repairs whether ordinary or extraordinary should be charged to the appropriate "Primary Operating Expense" accounts. Extraordinary repairs which have been provided for by adequate charges to depreciation should be concurrently charged to account "Reserve for Accrued Depreciation" and credited to account "Repairs Charged to Reserves—Cr."

19. **Cost of Repairing.**—Cost of repairing includes all wages, salaries and fees, paid employes directly engaged in the work of repairs; personal expenses of such employes when borne by the utility, the cost of material and supplies consumed and the expense of facilities employed in making the repairs, less the value of any salvage. It includes also the cost of direct supervision, such as foremen or superintend-

ents of repair gangs, but does not include the cost of general supervision.

20. **Depreciation of Plant and Equipment.**—Utilities should include in operating expenses depreciation charges for the purpose of creating proper and adequate reserves to cover the expenses of depreciation currently accruing in the tangible fixed capital. By "Expenses of Depreciation" is meant the losses suffered through the current lessening in value of tangible property from wear and tear (not covered by current repairs); obsolescence or inadequacy resulting from age, physical change, supersession by reason of new inventions and discoveries, by changes in popular demand or in public requirements; losses suffered through destruction of property by extraordinary casualties. The amount charged as expense of depreciation, should be based upon rules determined by the accounting utility. Such rules may be derived from a consideration of the utility's history and experience. Utilities should be prepared to furnish the commission upon demand, the rules and a sworn statement of the facts, expert opinion and estimates upon which they are based. The estimate for depreciation of physcal property should take into account: the deterioration and ultimate retirement of units of property which may be satisfactorily individualized, such as buildings, structures, machines, units of equipment, valuable instruments, etc., to the end that by the time such units of property go out of service there shall have been accumulated a reserve equal to the original money cost of such property plus expenses incident to retirement less the value of any salvage. The depreciation accruing in property which cannot be readily individualized, such as pole line, wires, cables, conduits or other continuous structure, where expenditures for repairs or replacements of individual parts ordinarily are not actually made until the later years of the life in service of such property and when made may, therefore, be classed as "Extraordinary Repairs."

The rate of depreciation should be fixed so as to distribute as nearly as may be, evenly throughout the life of the depreciating property, the burden of extraordinary repairs, and the cost of capital consumed in operations during a given month or year, and should be based upon the average life of the units comprised in the respective classes of property.

The amount estimated to cover the expense of depreciation should be charged monthly to account "Depreciation of Plant and Equipment," and concurrently credited to account "Reserve for Accrued Depreciation."

Account "Realized Depreciation Not Covered by Reserve" is provided in the "Corporate Surplus or Deficit" account for charges for realized depreciation on tangible fixed capital retired, when such depreciation accrued prior to the establishment of account "Reserve for Accrued Depreciation," or has not been provided for by credits to that account.

21. **Extraordinary Casualties and Unanticipated Reconstruction.**—If so authorized, upon application to the commission, the utility granted such authority may charge the amount named in the authorization to a "Suspense" account for the purpose of distributing over a limited period, an extraordinary loss of such a nature that it cannot be anticipated by the exercise of reasonable prudence. Losses of this sort may be due to the requirements by lawful authority or public necessity for improvements involving the abandonment of a considerable portion of plant and equipment before it has attained its normal life in service, or to an extraordinary casualty entirely unforeseen and unprovided for. The original cost of the property so abandoned or destroyed, should be credited to the "Fixed Capital" accounts, in which it was carried, and such portion of the cost as may be authorized by the commission may be charged to the "Suspense" account. The remainder of the cost less any salvage, being charged out as eleswhere provided in case of retirement of property. The "Suspense" account so raised should be credited and account "Extraordinary Depreciation" debited monthly with such an amount as will through its regular application amortize the amount of the loss at the end of the period designated. All ordinary casualties (those which occur with such frequency that the principles of insurance are applicable thereto) should be provided for through an insurance reserve maintained for such losses, or be included in the provision for depreciation of plant and equipment.

22. **Apportionment of Revenues.**—Revenues derived from a particular service shall be credited directly to proper revenue account prescribed herein. Where a lump sum is received for two or more utility services, and the agreement of sale does not specifically set forth the price of each, unless otherwise provided in the text to accounts, the amount may be apportioned on equitable rules determined by the accounting utility. Utilities will be required to show in annual reports to the Railroad Commission, the revenue received from each municipal corporation and quantities of the respective commodities supplied, also similar information with respect to commodities sold other utilities for redistribution and sale; all revenue from without the state; revenue derived from service within the state subdivided so as to show total revenue and quantities by each city, town or village.

23. **Apportionment of Expenses.**—Expenses shall be localized to Oregon where such localization can be equitably made, those common to operations in two or more states may be apportioned, unless otherwise specifically ordered, on equitable rules determined by the accounting utility. Localize expenses due to the rendition of service in each city, town, or village within Oregon with view to convenient analysis when required.

If more than one plant is operated; different facilities or processes used for production of commodity sold; joint utility services rendered; or other business is engaged in, direct expenses shall be appropriately localized; expenses not capable of localization may be apportioned on equitable rules determined by the accounting utility.

24. **Equitable Rule Defined.**—By "Equitable Rule" is meant bases and formulae, determined by current tests or by statistical data from past experience that will justly apportion the joint revenue or expense burden not arbitrarily fixed percentages (i. e., 50 per cent, 25 per cent, 20 per cent, 5 per cent), unless justifiable by facts in the case. Nothing in the way of rents shall be charged by one department to another department in the same utility for the use of plant or equipment.

FIRES AS A CAUSE OF SHORT-CIRCUITS ON HIGH VOLTAGE LINES.

BY J. C. CLARK.

In the summer of 1912, persons interested in the construction and operation of a high voltage power transmission line which traversed a public park applied to the board of park commissioners for permission to clear away shrubbery from the ground

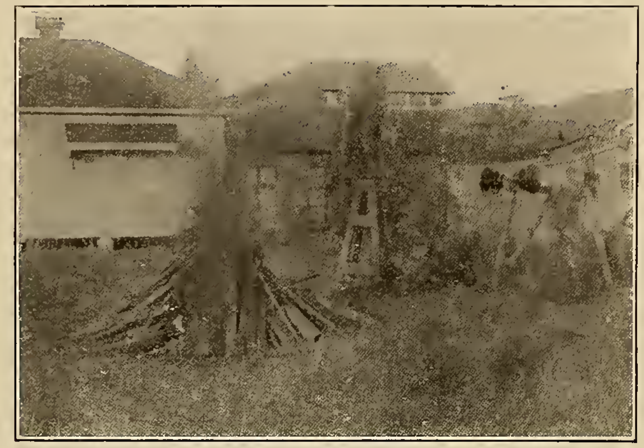


Fig. 1. Showing Manner in Which First Test Was Made.

beneath the line in order to prevent possible damage to the line from fires. This permission was refused, and a dispute subsequently arose over the question as to the possibility of short-circuiting the line by flames occurring in the shrubbery. In order to throw light upon the matter certain tests were conducted at Leland Stanford Junior University by Professor H. J. Ryan, and the writer in November, 1912, and February, 1913, for the purpose of demonstrating whether or not it is possible to short-circuit such a line through the agency of flames between and around the wires.

It may seem to some that, from our knowledge of the work of the electro-physicist in studying the conduction of electricity through gases, no experiments were necessary to demonstrate the ability of flames to produce short-circuits. The writer believes, however, that experiments like the present have particular value in being on a sufficiently large scale to indicate beyond doubt to the man engaged in the practice of electro-technology what may be expected in that practice; whereas, the laboratory achievements of the physicist are quite commonly of so refined and delicate a nature that it is difficult for the layman to project their significance into engineering practice.

Fire-tests were conducted by two methods. In the first test, two No. 10 copper wires were stretched 30 in. apart, and 5 ft. above the ground. These were insulated from ground, and from each other, and high voltage was applied to them from a source having its middle point grounded. A pine wood fire was built on the ground under the wires so that the bright flames filled the space around and between the wires. A photograph (Fig. 1) was taken to show the manner in which this test was carried out. Portable instruments were inserted in the low-voltage supply to the high-voltage transformers, and readings were made of the voltage, current, and power taken by the fire. Current and power fluctuated violently over a wide range.

In the second fire-test, the fire was built upon a platform approximately 6 ft. sq., insulated from the ground, (Fig. 2). This platform was covered with earth; sheet iron was then laid over the earth, and the wood for the fire was piled upon the iron. A pipe-frame 5 ft. sq. was covered with wire netting and was suspended with its plane parallel to that of the platform while its distance above the platform was made adjustable over a considerable range. High voltage from the same source as used in the first fire test was applied between this square of netting, and the sheet-iron at the base of the fire.

In both tests it was evident from the instrument readings that the flames conducted much current at all times directly between the terminals used, but the striking feature of both tests was the manner in which the current "cored up" intermittently into bright, thin streams of conduction, immediately pro-

Fig. 2. Showing Test Fire Insulated From Ground.

ducing short-circuits. These cores appeared in a very irregular manner, which was clearly due to the great, and continuous, variations in the amount, and disposition of the flames between the wires.

The following data were taken during the second fire tests, and show in a general way the electrical behavior at such times that readings were possible. It should be borne in mind that a great many short-circuits occurred throughout the progress of the test, and it was impossible to secure a satisfactory record of these:

Volts at Fire.	Milli-amperes through Fire.	Watts input to Fire.	Remarks.
108,000	7.96	860	Flames 18 in. to 24 in.
108,000	5.46	590	above screen; 2 ft. of
115,000	2.09	240	fire from wood to screen.
104,000	9.62	1000	Screen 4 ft. 6 in. above
108,000	2.87	310	wood, and at the top of
108,000	4.35	470	flame-tips.
108,000	3.70	400	
108,000	4.72	510	Tips of flame thinning as they hit screen.

It is clear to all who witnessed the tests that flames will readily produce short-circuits between

high-voltage conductors; and it is believed that this fact is of considerable importance in the cases where, for any reason, it is not possible to clear the ground of brush or timber beneath such lines, and where such material is capable, in burning, of laying a flame across the wires.

RECENT REGULATORY MEASURES AFFECTING PUBLIC UTILITIES.

BY O. B. COLDWELL.

(The author of this paper describes the gradual awakening of public utilities to the fact that their business had a special relationship to the public, their acceptance of commission control and its value in assuring a square deal to all. He then describes the various commissions, their work and purposes, and the methods they employ. This paper was presented by Mr. Coldwell at a recent joint meeting of the Portland Sections A. I. E. E. and N. E. L. A.—The Editors.)

It is not not very long since the officers of public utility companies looked upon their business in the same way that the ordinary business man looks upon his business. Had you suggested to the public utility official that his concern was a semi, or quasi-public institution, and therefore he must submit to certain restrictions upon his methods of doing business, he would not have agreed with you. He had been accustomed to regarding his business in the manner of the ordinary business man. There was a scale of rates, to be sure, that was pretty generally adhered to, but special discounts and other devices were in vogue, for the purpose of securing business the same as they were and are in vogue in other lines. This is all changed. Gradually the central station fraternity has been led up to the belief that its business is no longer a private business. They have been getting used to the idea that public utility companies are in a large measure the servants of the public, in fact, to believe that the public must be considered before anything else. They now take kindly to the idea of regulation by commissions and have actually begun to believe that it may be the best thing after all. The technical journals of today are largely devoted to the investigations which are being made, decisions rendered and regulations promulgated by public utility commissions. We are all imbued with the idea that the regulating commissions are bodies created expressly for the purpose of seeing that everybody, including the utilities themselves, gets a square deal.

The most prominent regulating body of the kind in question is the interstate commerce commission. This particular commission has to do principally with the main line railroads of the country and enters into all of the relations which these roads have with the public. The findings and rulings of this commission have become widely known and it has, in a large measuse, set the pace in methods of procedure which are being followed by the various state commissions. While the interstate commerce commission has already undertaken some weighty tasks, it is at present about to enter in on a piece of work which will be by far the most important yet undertaken by it. I refer to the valuation of the properties of the main trunk railroads of the United States. This will be a work of great magnitude and will no doubt engage the attention of the commission for several years to come.

The state railroad and public utility commissions are likewise important regulatory bodies, and as they deal with light and power, gas, water, telephone, telegraph and street railway companies, as well as the trunk railways of their individual states, the public utility people generally are perhaps better acquainted with the state than they are with the interstate commission. These commissions have now been created in many of the states, and an immense amount of work has been accomplished by them in investigating every phase of the utility companies' business and the relation of such companies to the public.

In addition to these commissions, there are other bodies which to a greater or less degree have to do with the carrying on of a public utility company's business, such as the department of public utilities of the city, the board of fire underwriters, public safety leagues, health boards, state bureau of labor covering factory inspection, state water board, etc., in fact, it would seem that the different commissions and special boards are here to stay and that these bodies, national, state, municipal, civic or otherwise, are destined to take a hand in the regulation and handling of our public utility companies. It is not my purpose to do any more than merely mention these various bodies and designate in a general way what they aim to do.

In this state, the railroad commission with jurisdiction over the utility companies, has recently approved a uniform classification of accounts for light and power, water and gas utilities. This classification of accounts embodies some of the latest ideas on the subject of accounting for utility companies and aims to have the accounts themselves expressive of the various operations performed by the utility in rendering the diversified classes of service it renders.

The commission has likewise issued a tentative set of regulations governing the methods of measuring amounts and quality of service furnished by electric, gas and water companies.

The commission at the present time is engaged in the preparation of certain rules which will have to do with pole line construction throughout the state.

The methods employed by the commission in undertaking work of this kind are worthy of mention. In each case the various utility companies are invited to participate in the preparation of the regulations under consideration for the purpose of securing measures which will be as complete and satisfactory as possible, and it may be remarked that there is in general a hearty co-operative spirit manifested by all concerned.

At the present time there is in course of preparation in conjunction with the public utility department of the city of Portland, a joint pole agreement which it is confidently expected will be of benefit to the public and likewise to the companies operating in the city.

The railroad commission has been working for some time on certain rules pertaining to the standardization of line construction in the state and making safer some features of such construction, especially crossings, etc. Other regulations of the commission pertain to station construction. In conclusion, I will say that it has been my observation that all public utility companies in this section have an ear to the ground in an endeavor to be up to date on all matters pertaining to the proper conduct of their business and are in a remarkable degree ready to cooperate with any of these regulatory bodies in an endeavor to secure better results.

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FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Competitive Telephone Service.

One of the most important occurrences at the passing of the old year is the thawing out process of the icy isolation of the American Telephone & Telegraph Company. Hereafter physical connection for independent companies with that system for the delivery of messages to places other than that of origin will be possible throughout the nation; the advantages of competitive telephone conditions have been created.

At practically the same time that the Federal government made public the reorganization plans of the American Telephone & Telegraph Company, which includes these provisions, a decision of interest was rendered by the California Supreme Court relative to a suit brought by the Pacific Telephone & Telegraph Company against the Railroad Commission of California.

This suit grew out of the commission's order compelling the Pacific company to make physical connection to certain competitor's lines so that their subscribers might use the Pacific company's toll lines for long distance conversations.

Although the commission had fixed rates for this service its order was annulled as it was conceded that no compensation had been given for the act of forcing the Pacific company to share its system with rival companies. The court took the view that the ruling of the commission was not an act of justifiable regulation and control but a taking and using of the Pacific company's property without compensation; a violation of the Constitution of the United States.

In the reorganization plans of the American Telephone & Telegraph Company no provision appears to have been made for reimbursement for the use of its system by competitive companies other than the collection of regular toll charges, and this ruling is therefore a matter of added interest on that account.

This reorganization plan originated with the company and its purpose was ostensibly to avoid litigation which would probably have resulted in the enforced dissolution of "the telephone trust."

The company's action is one more indication that public utilities are more than ever inclined to cooperate with the public in mutual interest partnerships; they are awakening to the fact that their part is to serve the public; that they profit most in this way.

The public intend to be served competently and with fairness; the honest utility will be protected.

The agreement made will not, it is said, affect the suit entered several months since to dissolve the connection of the American Telephone and Telegraph Company with the Pacific Telephone and Telegraph Company which suit will be pressed by the government to determine how far the Sherman anti-trust act applies to telephone companies. On the other hand, it is confidently affirmed by officials of the Pacific Company that the Government through acceptance of the offer of the parent company now has no grounds for its complaint that the combination is one which is in restraint of trade.

Retrospect and Prospect

The New Year comes to the electrical industry with the promise of improved business conditions; hastened by the facility of adjustment, resourcefulness and enterprise of the American people. During the year just passing the national business load curve showed too deep a valley of financial depression, but the new year finds the trend upward. That the complete cycle of operation will bring the inevitable peak of business is the promise of the New Year.

On the Pacific Coast during the past year has been built into its history a record of achievement. Projects unattempted elsewhere have here been accomplished. Generating units have been increased in size and records broken only to be immediately broken again, higher voltages have been successfully used for transmission over longer distances; efficiencies have been generally improved and new uses found for electrical energy.

Into the promise of the New Year is projected the business impulse back of concentrated and co-operative effort along broader lines than have heretofore been considered, and under more auspicious circumstances and conditions than have ever before heralded such a united purpose. The past year has been one of remarkable growth, despite untoward conditions, and prospects for the future are even better.

Withal the relationship between the public and the public utility has through the medium of commission control been placed upon a firmer footing. This rests upon the common basis of complete utilization, which includes maximum service at minimum cost, and a square deal for all.

Under these conditions capital is easier, is being attracted more readily to public utility enterprises and especially to those in the West.

The feeling of Optimism, well-founded, is growing—and why not? The mineral output of all Pacific Coast states shows remarkable increases, the promise of good crops is virtually realized; the lumber industry is operating at full capacity; and with money firmer and all other business feeling confidence in an assured growth and development there is arising a wave of confidence which should sweep the West with prosperity.

So closely interwoven with the success of forest, farm, city and field is the success of the electrical industry that this consequently obtains also. Business conditions for the New Year are promising.

The People Profited

If a crop season passes and the tillable land is not cultivated a source of wealth is wasted. Underground water supplies unless raised to the surface of the ground and utilized are valueless. The mountain torrent in the heights which are silent save for the sound of its tumbling downward, is of value to none. But harnessed and applied to the pumping of water to the thirsty land it is of great service to man. Then follows the miracle and the desert blossoms as a rose. This illustrates conservation by wise utilization.

In the east half of the San Joaquin valley of central California, foresight and enterprise have combined these forces and secured the predetermined results. The hardship and uncertainty of dry-farming has fast given way to the cultivation of more varied, more prolific and more profitable crops. A development which is remarkable is the result.

It might have been feasible to use simple means, such, for example, as the shadoof of the Egyptians operated by one man power. But neither the crudities of inefficient hand operation or even gasoline or steam power pumping could have accomplished so much even if progress could have been made at all. Here as a result of the happy combination of a good soil and climate together with cheap hydroelectric power and a reliable supply of underground water man is able to raise practically any crop which the market demands.

Cities and towns, and necessary transportation facilities have sprung into existence as a natural consequence of this successful agricultural development, which in turn depended upon the initiative and enterprise of the Mt. Whitney Power & Electric Company. The improved conditions and service and the increased values which that corporation made possible places the public served forever a debtor.

That the public may prove a perpetual beneficiary argues against the especial taxation of private corporations which as public utilities properly develop water power sites, merely on the ground that they are utilizing the otherwise valueless property of the public. The people benefit most.

The Mt. Whitney Power & Electric Company has 1262 miles of transmission and distribution system which reaches to practically every part of the territory served. Yet there is but 8½ per cent of the 1,000,000 acres of tillable soil contiguous to this network of power lines, brought under cultivation. The possibilities are vast.

There is an average of nine and one-half horsepower in motor load to every mile of power line. The pumping load for which the system was designed, now absorbs 70 per cent of the kilowatt-hour output of the plant. This plant, together with the reconstruction now under way aggregates 33,000 horsepower.

The equitable system of charging for power is especially noteworthy as it encourages cultivation of the small as well as of the large tract of land.

The population now served by this company has increased to 60,000 and there are naturally many industries springing into existence to cater to the needs of this growth.

One of the remarkable engineering features in this system is the bench construction of part of the conduit of formed concrete slabs. These slabs were molded and then hauled into place from the point of manufacture, the bottom of the conduit being mixed on the ground except where elevated in which case the horizontal slabs are also molded.

There is one other point to be made in passing. Just as the steam engine first brought country folks together into cities that they might work in factories at machines utilizing centralized power, so now the electrical distribution systems of central stations invitingly reaching out into the agricultural districts with their promise of city comforts and conveniences on the farm, are appropriately encouraging the return of the people to a more desirable country life.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Paul Shoup, president Pacific Electric Railway Company, Los Angeles, is at San Francisco.

F. H. Welling, Pacific Coast manager Federal Sign System, was at Los Angeles last week.

F. Baker with J. C. English Company, Portland, was at San Francisco during the past week.

C. I. Kephart, commercial engineer Sierra and San Francisco Power Company, is at Los Angeles.

H. A. Kluegel, chief engineer Mt. Whitney Power & Electric Company, paid a visit to San Francisco last week on company business.

G. M. Gest, engineer and contractor, announces the removal of his executve offices to suite 1330-36, Woolworth Building, New York.

A. D. Hotson of Vancouver, British Columbia, has been elected to the grade of member of the American Institute of Electrical Engineers.

F. D. Fagan has been appointed sales manager of the San Francisco office of the Edison Lamp Works of General Electric Company.

Henry T. Scott, chairman of the executive board, Pacific Telephone and Telegraph Company, has returned to San Francisco from Washington, D. C.

L. Tenney-Peck, president First National Bank of Honolulu and of the Honolulu Electric Railway Company, passed through San Francisco last week en route home from Washington, D. C.

C. L. Cory, professor of electrical engineering at the University of California, Berkeley, has been appointed local representative of the Board of Examiners of the American Institute of Electrical Engineers.

H. F. Holland, intermountain representative of the Simplex Electric Heating Company, left Salt Lake City last Saturday to spend the holidays with his family in Boston, Mass., and also to make his annual visit to the Simplex factory at Cambridge.

R. F. Hayward, Western Canada Power Company, Vancouver, B. C., was appointed local representative of the Board of Examiners of the American Institute of Electrical Engineers at the meeting of the Board of Directors, held December 12th.

J. B. Sunderland, who has filled an important position in the comptroller's department B. C. Electric Railway Company, Vancouver, B. C., will sever his connection with that company to take charge of the agency department, Macdonald, Marpole & Company in that city.

G. I. Kinney, Pacific Coast manager for the Fort Wayne Electric Works and the Sprague Electric Works of the General Electric Company, has returned to his San Francisco offices after an extended trip through the East, having returned by way of Seattle and Portland.

L. M. Wood, for the past seven years purchasing agent of The Wesco Supply Company, St. Louis, Mo., has resigned to become sales manager of the Menominee Electric Manufacturing Company, Menominee, Mich.

E. J. Barry has opened offices as consulting and construction engineer in the Tacoma Building at Tacoma, Wash. Mr. Barry is well known as a specialist on the application of electricity to the lumber industry, having but recently completed a great work of this character for the St. Paul & Tacoma Lumber Company.

F. G. Baum, chief engineer Lake Spaulding Development, Pacific Gas & Electric Company, was the guest of honor at a banquet tendered to him at the St. Francis Hotel last Friday. The heads of departments interested in this development, representatives of those firms supplying machinery and materials and several prominent engineers were present. The guests numbered 175.

John Coffee Hays and **H. T. Hays** of the Mt. Whitney Power and Electric Company of Visalia; **A. Emory Wishon**, **E. B. Walthall** and **E. D. Farrow** of the San Joaquin Light and Power Corporation; **Whitman Symmes**, mine manager of Virginia City, Nev., and **L. F. Youdall**, electrical contractor at Stockton, Cal., were out-of-town participants in the "wasshael" luncheon at San Francisco on December 20th.

MEETING NOTICES.

Los Angeles Engineers and Architects' Association.

This association held its regular meeting at the Hollenbeck Cafe on Thursday evening, December 18th, when Ralph J. Reed presented an interesting paper on "Oil Transportation in California." There was a good attendance.

Utah Society of Engineers.

An interesting discussion on "Good Roads" was given at the regular monthly meeting of the Utah Society of Engineers Friday, December 19th, in the Stock Exchange Building. Papers on this important subject were presented by E. R. Morgan, State Road Engineer; Richard R. Lyman, vice-chairman of the State Road Commission; and Arthur E. Fox, purchasing road engineer of Boise, Idaho.

A. I. E. E. Directors' Meeting.

At the board of directors' meeting held in New York on December 12th, Section 51 of the Institute by-laws, limiting Section territory to points within sixty miles of the meeting place of a Section, was amended upon the recommendation of the Section's committee, so as to permit the board of directors to extend this territory in cases where such extension is warranted by conditions such as obtain with some of the Pacific Coast Sections.

The Standards Committee reported recommending the publication in the proceedings of the preliminary report of the Joint Rubber Insulation Committee, an unofficial body representing various manufacturers and users of rubber compounds, which has been at work for two years preparing a standard specification and analytical procedure for 30 per cent Hevea rubber insulating compound.

Los Angeles Section A. I. E. E.

Members of the Los Angeles Section of the American Institute of Electrical Engineers will inspect the local telephone exchanges on Monday evening, December 29th. It is proposed to meet at the exchange of the Home Telephone & Telegraph Company at 8:00 p. m. Mr. Keller will give an informal talk on the automatic system. Later, the members will visit the main exchange of the Pacific Telephone & Telegraph Company, where Mr. Dix will take charge of the party.

For the January meeting of the Los Angeles Section of the American Institute of Electrical Engineers, Mr. P. S. Taylor of the Riverside-Portland Cement Company, will present a paper on "Precipitation of Dust from Rotary Cement Kilns."

Utah Electric Club.

At the regular luncheon of the Utah Electric Club at the Commercial Club Thursday, December 18th, W. C. Stark, Assistant Secretary of the Commercial Club of Salt Lake City, presented some figures which have been compiled by the club as to the proposed one million dollar bond issued by the County Commissioners of Salt Lake County for the installation of a complete system of good roads. He showed what other States, particularly California, had done in this respect. After a rather spirited discussion the club passed a resolution memorializing the County Commissioners as favoring this bond issue and urging them to take immediate steps to have the necessary election to provide this money.

The ball given by the Utah Electric Club at the Majestic Dancing Pavilion Friday, December 19th, was declared to be the most successful social event the club has attempted. Special street car service to the pavilion was provided by the

Utah Light and Railway Company, and every detail necessary for the smooth running of an event of this character had been carefully attended to by the Social and Entertainment Committee under the direction of W. W. Torrence, chairman.

Wass-hael Luncheon.

Agreeably to invitation about two hundred and fifty electrical and machinery men assembled at luncheon in a San Francisco cafe on Saturday afternoon, December 20th. Here was celebrated with true Christmas spirit a revival of the old English custom of "wass-hael," or wassail. This third annual luncheon was presided over by T. E. Collins, who with the generous assistance of an able committee had "counselled with ye cooks and kellermen in making choice of ye victuals more delectable and wynes more mellow than hath ever been served in all Britain." Pipers and fiddlers dispensed lively airs and many talented fellows entertained with their song, music and stories. Among those present were:

Affolter, P. H.
Allen, Bert
Baker, F. D.
Baker, J. S.
Barker, G. L.
Beardsley, E. W.
Beattie, Cliff
Benchley, W. W.
Bendel, W. T.
Bibbins, T. E.
Bivins, W. T
Black, Jos.
Bragg, I. H.
Bridges, J. E.
Briggs, A. G.
Briggs, Herbert F.
Briggs, W. W.
Brittingham, Walter
Brooks, Fred
Bulotti, Chas.
Burden, F. A.
Burton, M.
Butler, W. W. S.
Butte, C. F.
Cameron, Ewen
Carter, H. V.
Chapman, H. F.
Clinton, W. J.
Cole, Waldo
Collins, Geo. C.
Collins, T. E.
Cook, C. B.
Cook, M. H.
Cooper, N. K.
Corvin, Harry
Craig, Wm.
Crilly, Jas.
Crosby, J. W.
Curtis, Geo. H.
Daley, H. H.
Degen, Tom
DeLancie, H. S.
DeRemer, J. G.
Dodd, W. G.
Douglass, R. L.
Dredge, Theo.
Drendell, Al.
Dunbar, F. A.
Dunbar, W. R.
Eltringham, Robt.
Enright, Frank R.
Ettienne, Emil
Farrow, E. D.
Ferris, Capt. Frank
Fowden, Frank
France, R. L.
Froding, Chas.
Gillis, Samuel
Goodwin, Wm.
Gregory, S. B.
Gribble, E. C.
Grigsby, Chas.
Griswold, A. E.
Hacke, H. C.
Hagedorn, Geo.
Halloran, A. H.
Hammersmith, A.
Hand, Harry
Hand, Roy
Hanbridge, W. S.
Hanford, Albert
Hardie, L. N.
Hardy, C. E.
Harkness, H. L.
Harper, S. L.
Harriman, M. A.
Harris, Dave
Hartzell, H. F.
Harvey, A. M.
Hawkins, A. J.
Hawkins, S. L.
Hays, Harry T.
Hays, John Coffee
Hays, T. A.
Heath, J. G.
Heise, C. E.
Helfrich, L. C.
Henry, Geo. J.
Herbert, Al
Herbert, C. D.
Herr, Bennie
Herzog, Mel
Hess, V. E.
Hillis, Chas.
Holabird, Russ
Hughes, H. H.
Hunt, E. A.
Hussey, H. A.
Hutchinson, Eli
Irwin, A. M.
Jackson, H. F.
Johnson, Sam
Johnson, W. C.
Jones, G. D.
Jones, H. T.
Joy, A. C.
Kahn, Axel
Keenan, Walter
Keene, R. E. G.
Kendall, E. J.
Kephart, C. C.
Kerr, L. B.
Killam, C. L.
Kimball, G. E.
Knapp, J. E.
Laumeister, Chas., Jr.
Le Coste, Dr. Henry
L'Hommedieu, W. P.
Lindsay, Robt.
Linge, C. W.
Maden, Emil
McAlmon, H. R.
McCants, M.
McCarthy, E. H.
McCord, O. P.
McDonald, R. F.
McKinley, W. L.
McLean, Jos.
McNeilly, Robt.
McNulty, F. W.
Miller, Frank
Miller, N. B.
Moitoza, A.
Moldrup, E. J.
Moore, Pierre C.
Moore, Dr. H. W.
Morris, T. C.
Murphy, Chas.
Nadon, J. A.
Nott, L. A.
Odell, L. L.
Otterson, N. E.
Paddock, Paul
Pahl, A. J.
Peterson, M. B.
Pottinger, J. J.
Pounder, W. H.
Quarg, R. F.
Quinn, E. A.
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Rhine, M.
Robb, R. T.
Robinson, J. I.
Robscheidt, Hans
Rosenlund, E. T.
Rowe, A. E.
Rowe, J.
Russell, Sam
Sanderson, Jack
Schessinger, O. A.
Schloss, E.
Scobey, M. L.
Searight, Harvey
Seaward, G. A.
Seiler, H. J.
Shepard, Wm.
Sherman, H. E.
Shields, C. E.
Shreve, E. O.
Somers, L. A.
Sproul, E.
Squires, H. B.
Squires, W. D.
Stateler, T. M.
Steele, Miles
Stillger, Geo.
Summers, Frank
Sutton, Chas.
Symmes, Whitman
Talbott, J. A.
Thompson, Joe
Thrall, Fred
Tilton, R. F.
Tobey, J. O.
Tubbs, L. C.
Victors, E. A.
Von Huysen, Jack
Wainwright, Jas.
Walthall, E. B.
Ward, L. T.
Ward, Wm. D.
Warren, E. E.
Watson, R. W.
Webster, Fred L.
Wedgewood, D. R.
Wemer, F. E.
Werner, W. F.
West, J. C.
Whaley, Edward
Wheeler, Frank
Williams, G. I., Jr.
Wilson, F. W.
Wishon, A. Emory
Wolden, R. L.
Wolf, H. S.
Woodbridge, J. E.
Wright, Chas.
Wright, Wm., Jr.
Youdall, L. F.
Young, Garnett
Youngholm, Al
Zoffman, F. P.

EXAMINATION FOR LABORATORY ASSISTANT (MALE).

On January 21 and 22, 1914, the United States Civil Service Commission announces an examination for laboratory assistant in the Bureau of Standards, Department of Commerce, Washington, D. C., at salaries ranging from $900 to $1200 a year.

The Bureau of Standards is engaged in research and testing of weights and measures, standards, measuring instruments, and materials. The work is similar to that in the better class of industrial and scientific research laboratories. Experience has shown that the probability of appointment of qualified eligibles is excellent. Advancement is through a series of graded positions to the grades of assistant physicist, associate physicist, and physicist. The Bureau possesses a valuable scientific and technical library in physics, chemistry, and engineering, and the facilities for its work are unexcelled.

Competitors will be examined in general physics, French or German, practical questions on each optional subject chosen, education, training and experience.

PACIFIC GAS ASSOCIATION.

(The following discussions are abstracted from the proceedings of the Pacific Coast Gas Association, 1913. The subheads are the names of the papers discussed, all of which have apepared in previous issues of this of which have appeared in previous issues of this journal.—The Editors.)

The Industrial Fuel Situation.

Van E. Britton:—There is often a lack of unity of purpose between industrial departments of the gas company and the engineering departments and the operating and maintenance departments. If it were possible to get those various departments under one directing head, a great deal more good could be accomplished for all departments. The trouble has been that the operating department has seemed to feel that its purpose and scope of work was completed when the gas was put into the street main. The sales departments were left entirely to their own resources towards developing the future sale of that product. The result is that there was no harmony, no integrity of purpose, between those departments, with the result that they were pulling away from each other. The industrial men aften blamed the operating department for the poor results obtained, where if it had been possible for one department to be responsible the blame, if any, could be placed where it belonged. Often poor appliances are sold by dealers who are looking for profit on the individual sale and care nothing for the maintenance or the final results obtained by that particular appliance. It is a mistake for gas companies to permit the installation of an appliance that is not properly built for the work intended. If they were to exercise some sort of supervision over the installation of all appliances intended for the burning of their particular product, a supervision that would extend to the point of an advisory capacity by their industrial engineers for the industry for seeing that the appliances installed for some particular purpose was the very best possible appliance which could be secured for that individual purpose, the results would be a great deal better for the reason that the consumer himself would become the salesman for the company, advocating the installation in some instances of some similar type of apparatus.

I call to mind an industrial concern in San Francisco that called upon me about a year ago for an estimate for building a gas making unit to supply their factory with gas, they being off from the main lines some distance. The information had not reached the commercial department, or, if it had, had not received the attention it deserved. Some arbitrary price was set and the matter was dropped. These people, realizing the benefits of gas over coke and crude oil, resolved to build a plant themselves. They found, however, that the cost of installing a generating plant was out of question. Even a similar amount for main extensions would give them a very much better supply and a very

much lower cost. The industrial department evidently got in touch with these people, and the result is that at present the main extension has been made for these people's plant and they are now using a very large quantity of gas monthly which is quite an added revenue to the company. These people with their competent engineers realized the benefit of fuel gas, but seemed to think that it was out of the question for them to secure the gas from the local distributing company. There is a matter that comes up to the publicity department. Therefore it seems to me that each of the different departments of a gas company is an integral part, each one radiating from the hub, which, of course, is the general manager. All those various spokes of the wheel are as essential to the proper work of the company in securing the ultimate results in dividends to the stockholders as any other part. The operating department is no more important than the sales department, nor is the sales department more important than the publicity department. It is to the sales department particularly that the final disposition of the product is due. Unless their efforts are directed toward the disposition of that product, no matter how cheaply the product may be produced in the generating plant, it is of no value to the stockholders. If it is possible the sales department should see that all possible appliances, no matter of what particular type or construction, should be thoroughly investigated and presented to the public in a way that will meet their approval and attention. In some of the larger cities in the East there are large stores devoted to the proposition of giving to the manufacturers the various appliances, and particularly to make a permanent supply, very much like the place in Philadelphia where machinery merchants are given an opportunity to display their wares. If such a thing is possible and the companies for the manufacture of all appliances will have an opportunity to install a permanent display where the public can be courteously received and treated, where the little niceties of life can be presented to them, will draw the public in to see the new developments in the business. When that time comes there is going to be a tremendous stride in the sale of all sort of gas and electric appliances. There are a great many things on the market in both lines that are unknown to the public at large. For example, to recite a little personal incident, when my baby was born it was up to me at 2 o'clock in the morning to go down into the kitchen, light a gas fire, heat some water, boil a bottle of milk and bring it back. The time elapsed was about 15 minutes, as a rule. In the meantime baby was crying very hard and mother was getting very nervous. I happened to go into an appliance store in San Francisco and saw an advertisement of an electric nursery bottle heater. I had never heard of such a thing, although I had directly or indirectly been connected with gas and electric appliances. I immediately purchased one, the result being that at the first peep from the baby we simply pulled the chain switch and by the time the baby was awake and ready for the bottle the bottle was ready for the baby.

Report of Committee on Gas Engineering Degree.

E. C. Jones:—The work accomplished last year at the University of California showed beyond a doubt that Mr. Britton's idea of having a gas engineering course at the University is a good thing, and that it is bound to be a success; in fact, it is a success today. The six lectures which I was privileged to read to the students last year were received with such attention and enthusiasm that as I looked into the faces of those young men as they were listening to my remarks, I felt as though I was the best paid man at the University of California. I received my reward for every lecture, in the interest and appreciation of those young men. The lectures were attended by large audiences, including the 18 students in the course of gas engineering, and others from the chemical and mechanical engineering departments of the university. The gas business which is so familiar to us is more or less mysterious to even the students in the mechanical engineering department at this great university. The interest was so great that these young men gave up their holidays and worked overtime and visited the different gas works around the bay, put on overalls and jumpers, and learned the practical side of the business. They took hold of the generator valves and operated, and we found that in order to satisfy the minds that were reaching out for new ideas that some of the old boys in the game had to review their early lessons. It became a study for us who were trying to help these boys to answer their questions and start them off on the right track. I feel today that we are accomplishing a great work. We owe it all to Mr. John A. Britton for having persisted in starting it and making it possible. I have been a member of this committee for the last five or six years. I have personally stood in the way of the accomplishment of this great purpose. I didn't know enough to see its possibilities, and finally after they took me off as chairman and made it posible for a live man to get in and carry out the scheme, I found that I was entirely mistaken and that Mr. Britton's ideas were right and are today bearing fruit. In years to come the name of John A. Britton will be repeatedly connected with the gas engineering course in the University of California and I don't know of a better monument that a man can have. Granite monuments will waste away from the physical effects of the elements, but such a monument as he has erected for himself will grow and blossom as time goes on.

TRADE NOTES.

The Boicourt Electric Company, Portland, Ore., is installing the electric wiring in the three-story brick building on Sixth street N., belonging to J. M. Jones.

The Pacific Electric Railway Company has let a contract for grading about five miles of right of way between Hawthorne and El Segundo, to Robert Sherer & Company.

Morrison Electric Company, Portland, Ore., has just completed the installation of the "Roughing In" work in the new Carnegie Public Library, built by the Hood River County Library Association at Hood River, Ore.

West Coast Engineering Company has the electrical contract for the electrical equipment of the building to be occupied by the Killiam Stationery & Printing Company, on the northeast corner Fifth and Oak streets, Portland, Ore. The job will all be in conduit and consist of about 500 lights together with 20 motors in the printing department.

The Booth-Kelly Lumber Company, Eugene, Oregon, has commissioned the West Coast Engineering Company, Portland, Ore., to make plans and specifications and make the complete installation of electric power and lighting in their new electric driven sawmill, having a capacity of 250,000 board feet in 10 hr., which is now being erected at Springfield. The installation will consist of motors ranging from two h. p. to 300-h.p. and the total will be about 2500 h.p., including the planing mill. There will be a three unit monorail system installed in the yards for handling lumber, and current for the monorail will be furnished by the use of a 100 kw. motor-generator set. General Electric induction type motors have been purchased for the entire mill. Power will be furnished by the Oregon Power Company.

NEW CATALOGUES.

Electric Cooking, "The Berkeley Way," is the title of an illustrated booklet just issued by the Berkeley Electric Cooker Company, Berkeley, Cal. Those who are interested in this subject will find the booklet well worth writing for.

Farie's patent adjustable electric brackets, portables, reflectors and shades; electric, gas and combination fixtures; fixture parts and fittings are listed in Catalogue No. 22, which is being distributed by the Pacific States Electric Company.

INDUSTRIAL

PIONEER ELECTRIC LOCOMOTIVES IN ALASKA.

What is claimed to be the first electric locomotives ever used in Alaska were placed in service within the past few months for mining operations by the Alaska Treadwell Gold Mining Company at Treadwell, Alaska. This company was incorporated in June, 1889, under the laws of the State of Minnesota for the purpose of taking over the Paris mine and reduction works at Douglas Island, which has been operated since 1882 by the Alaska Mill & Mining Company. The mine is an immense low grade ore proposition, the property being equipped with two mills having a total capacity of 540 stamps, power plants, foundry, cyanide plant, machine shop, saw mill, central hoisting and crushing plant, etc., practically all of which are either operated by electric power or being equipped for electric drive.

Type of Electric Locomotive at the Mines of the Alaska Treadwell Gold Mining Company.

The two initial electric mining locomotives are each of six-ton capacity and are operated on a 500 volt direct current circuit from an overhead trolley. They were manufactured by the General Electric Company and are of the standard outside frame type, in which the side frames are placed outside of the wheels. Each machine is equipped with two type HM-801 motors having ball bearing armatures.

The motors are of the usual series wound type and the controller is of the rheostatic magnetic blowout type. A commutating switch is incorporated in the reverse cylinder, the handle of which has four "on" positions, two for each direction of motion, one with the motors in series and the other with motors in multiple. This system of control, by permitting the motors to be started in multiple, allows them to exert their maximum tractive effort independently, so that the slippage of one motor does not affect the other. With the series connections economy in current consumption is effected while running, for the locomotive will then develop a given drawbar pull with one-half the current required with the motors in multiple, the speed, of course, being reduced in approximately the same ratio.

Some idea of the distance to which the use of electric mining locomotives has now penetrated the far north may be gained when it is stated that the mines at Treadwell are nearly 1000 miles north of Seattle, Wash.

THE LARGEST ELECTRIC HOIST.

The directors of the North Butte Mining Company, in a meeting at Duluth, recently voted to award to the Westinghouse Electric & Manufacturing Company the contract for what will be the largest electric hoist in the two American continents, and one of the largest of its kind in the world. This hoist will be installed on the new Granite Mountain shaft which at present is rapidly approaching the 2900 ft. level.

The hoisting drums, which will be 12 ft. in diameter, will be driven by a direct connected electric motor running at a speed of about 71 revolutions per minute. Power will be supplied to this motor from a motor generator set equipped with a 50-ton fly-wheel to secure elimination of the peaks that would be drawn from the power line during period of starting and acceleration.

Hoisting with this equipment will be done in balance, but the equipment is large enough to take care of unbalanced hoistings. Skips will be provided for handling the ore and each will have a capacity of 7 tons of ore. Round rope 1⅝ in. in diameter will be used and the equipment is designed for a normal rope speed of 2700 ft. per minute with a maximum of 3000 ft. per minute.

The capacity of the hoist will permit 300 tons per hour being hoisted from the 2000 ft. level or 200 tons per hour from the 4000 ft. level.

The system of control and power equalization used will be that commonly known as the Ilgner System, in which a fly-wheel driven by the motor generator set is permitted to give up some of its stored energy to supply the peak load drawn by the hoisting motor.

In order to reduce the fly-wheel losses to a minimum, the fly-wheel will be encased in a smoothly finished steel housing and provided with special type of self-lubricating bearings.

The hoisting motor will be of the type used in steel mills and will be of a very heavy construction. In fact, all of the equipment has been designed with absolute reliability as the paramount consideration. The electrical equipment alone will weigh in excess of 250 tons.

The special safety devices include electrically released brakes, automatic slow-down devices to prevent skip or cage ever going through head sheaves and a special controller to limit the speed when hoisting men.

The hoist motor will have a maximum intermittent rating of 4500 h.p. and the motor generator set will be driven by an induction motor having a continuous normal rating of 1400 h.p. The difference between these ratings represent approximately the amount of energy that will be supplied by the fly-wheel momentarily during starting.

The installation is so designed that the draft of power from the power line will be practically constant throughout any cycle of hoisting.

Some very high economies have been guaranteed on this installaticn by the manufacturer and its installation will be watched with interest.

NEWS NOTES

INCORPORATIONS.

PORTLAND, ORE.—Articles of incorporation of the Garibaldi Water Company have been filed by Chas. J. Schnabel, Newton C. Smith and J. B. Ofner, with capital stock of $15,000.

SANTA ANA, CAL.—The El Camino Water Company has filed articles of incorporation with a capital of $10,000. The object of the corporation is to bore wells and furnish water to its stockholders.

PARKER, ARIZ.—Parker & Colorado River Railway Company is to be the name of a new subsidiary corporation of the Parker Improvement Company. W. H. Tharpe is general manager. The purpose of the new company is to operate an electric railway in Parker and vicinity. Application for a franchise has been made to the board of supervisors.

SEATTLE, WASH.—The strategic dock site on the Renton waterway has been deeded to the Renton Real Estate Company. The company is empowered to operate and deal in gas and oil wells on the land or mine for gold, silver, copper, coal and iron. It is also authorized to deal and construct railroads, electric light plants, telephone and telegraph lines, and furnish light and power, and to deal in waterworks, smelters, foundries, etc. The capital stock of the corporation is $40,000. The incorporators are, Paul W. and Matilda Houser, C. L. and Eliza E. Dixon.

ILLUMINATION.

ALAMEDA, CAL.—Mayor Hugh Craig of Piedmont has asked the city of Alameda to supply Piedmont with light and power.

TACOMA, WASH.—The city council has ordered the installation of luminous arc lights on the principal business streets at a cost of $36,000.

SEATTLE, WASH.—An ordinance has been introduced to empower the lighting department to incur the expenditure necessary for the alteration and reconstruction of the substation at Yesler Way.

SAN FRANCISCO, CAL.—A resolution recommending that the board of public works and the city engineer's office prepare plans for the adequate illumination of those streets upon which municipal lines will be operated was adopted.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Corporation has filed an application with the commission for a certificate of public convenience and necessity to operate under franchises in the city of Pasadena.

BANNING, CAL.—The Banning Gas & Lighting Company has applied to the commission for a certificate of public convenience and necessity for the construction and operation of an electric distributing system in this city.

SANTA MONICA, CAL.—Sealed bids will be received up to December 29th for the installation of ornamental light posts, together with wires, conduits and other appliances necessary for installation of a lighting system on both sides of Fremont avenue.

HUNTINGTON PARK, CAL.—The Los Angeles Gas & Electric Corporation has been granted a 40-year franchise to construct and maintain a system of gas pipe lines with necessary equipment, to supply and distribute natural or artificial gas for light, heat and power purposes in this city.

SEATTLE, WASH.—In competition between the Municipal Lighting Plant and the Puget Sound Traction, Light & Power Company, the contract for the lighting of the county court house was awarded to the traction company, for the reason that they were able to make a lower price than the municipal plant.

SPOKANE, WASH.—Property owners along First avenue between Bernard and Cedar streets have taken out new petitions for the installation of a curb lighting system on this thoroughfare. The petitions have been drafted with the co-operation of Commissioner of Public Utilities C. M. Fassett and provide that at the end of 10 years the lighting system shall become the property of the city.

SALT LAKE CITY, UTAH.—The new Commercial Office and Electric Shop of the Utah Light and Railway Company, on South Main street, opened December 19th, is a convenience which the patrons of this company will greatly appreciate. Heretofore the offices of the company have been at a point quite inaccessible to the public for the payment of bills and the making of applications. The Main-street office has been fitted up at an expense of over $7500 to bring the company's service nearer to the people. Opportunity has also been taken to install a modern Electric Shop where the very latest things electrical will be on display. Following the company's policy of co-operating closely with the local electrical supply dealers, no appliances will be sold at this Shop, but prospective customers will be referred to the various dealers for these supplies. A special feature of the office is the exterior decorative lighting. Over 50,000 candlepower in signs, outline, window, marquee and post lighting render this office "the brightest spot on Main street."

TRANSMISSION.

SEATTLE, WASH.—The Board of Public Works has extended the date for the opening of bids for a steam electric plant from December 26 to January 2, 1914.

TACOMA, WASH.—Persistent rumors are current here that the Chicago, Milwaukee & St. Paul Railroad is behind the acquisition of water rights on the north of the Skokomish River for power producing purposes.

WILLITS, CAL.—The board of supervisors has adopted a resolution of intention to sell an electric power line franchise over certain roads in Mendocino county, this being done on the application of the California Telephone & Light Company.

HELENA, MONT.—A special election to decide whether or not a franchise to furnish electricity for heat, light and power purposes shall be granted the Standard Engineering Company of Seattle, will probably be held the latter part of January.

MOUNTAIN HOME, IDAHO.—Further electric development on the Malad River is under way and a second large plant which will generate 15,000 horsepower will be built early next year by the Idaho Power & Light Company, formerly the Beaver River Company.

KLAMATH FALLS, ORE.—The city of Klamath Falls has received a favorable response from the Department of the Interior relative to the establishment of a power plant in connection with the Klamath reclamation project. The government will furnish the power and build the plant, but the city must finance the proposition.

REDDING, CAL.—The Pitt River Electric Power Company has obtained from the Shasta County Board of Supervisors a franchise granting the right to develop and distribute power in Fall River and Burney valleys. A plant cost-

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